2017

Secondary Students' Perceptions of an Interactive Mathematics Review Program: An Action Research Study

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SECONDARY STUDENTS' PERCEPTIONS OF AN INTERACTIVE MATHEMATICS REVIEW PROGRAM: AN ACTION RESEARCH STUDY

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Submitted in Partial Fulfillment of the Requirements

For the Degree of Doctor of Education in

Curriculum and Instruction

College of Education

University of South Carolina

2017

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DEDICATION

To God be the glory… All to Him I owe!! To my wonderful husband, Michael, thank you for love and support through this extraordinary experience. Thank you for always making me laugh even when I really wanted to cry. We have one heart and her name is Nicole. To our daughter, Nicole, you will never know how much you are loved until you have your own children. Always believe in yourself and you will accomplish many great things in life. This has been a difficult journey and I hope to spend a great deal of time with both of you in the near future. To my wonderful mother, Sue, thank you for always encouraging me to pursue my dreams and demonstrating an incredible work ethic to allow this dream to come to fruition. Your pathway before me is the only reason I survived this challenging experience. To Bob, you took the step out of ~~step~~Dad, thank you for your love, support and encouragement… and for always using big words that I had to look up. I learned a few locutions! I love you all so very much.

ACKNOWLEDGMENTS

To my chair and major professor, Dr. Schramm-Pate, thank you for the wealth of knowledge you provided to the action researchers of Cohort B. You have established an amazing program for The University of South Carolina to provide us with a Doctorate of Education in Curriculum and Instruction. Thank you for empowering women and leading by example. To Dr. Lussier, thank you for providing challenging curriculum and supporting the process of building a conceptual framework to serve as the foundation for this research. To Dr. Vogler, thank you for helping to begin this journey by narrowing the focus of this research to Cooperative Learning Theory. Thank you to the University of South Carolina's College of Education and all of the professors who assisted in establishing an Interactive Mathematics Review Program (IMRP), which may change the lives of these remedial level students. Thank you to Susan Scott for standing beside me through this incredible journey, your friendship means the world to me. Thank you to my school district, principal, and students for allowing me to build a successful curriculum so that together we may see it prosper.

ABSTRACT

The present action research study describes an Interactive Mathematics Review Program (IMRP) developed by the participant-researcher to enable remedial algebra students to learn in a cooperative classroom with pedagogy that promoted collaboration and hands-on, active learning. Data are comprised of surveys, field notes, semi-structured interviews, and focus group insights about the IMRP over an 8-week period in the spring of 2017 at a southern, low-socioeconomic status high school. Findings include: (1) greater comprehension; (2) increased engagement and math-related discussions; (3) increased motivation; (4) egalitarian principles; and (5) high-quality reciprocity. A nine-step action plan designed to enable other math teachers at the school to separate remedial students into cooperative groups to learn algebra with a peer-mentoring component is scheduled for weekly in-service sessions in the fall of 2017. The results of this study, in concert with students' perceptions of the IMRP model, will be shared with other math teachers in a professional learning community, and a reciprocal plan to increase progressive pedagogy throughout the school for continually monitoring and assessing improvements in student learning will be the focus of the action plan.

Keywords: algebra, action research, interpersonal skills, positive relationships, collaboration, positive interdependence, active learning, accountability, egalitarian principles

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CHAPTER ONE: RESEARCH OVERVIEW

> The educator is responsible for a knowledge of individuals and for a knowledge of subject-matter that will enable activities to be selected which lend themselves to social organization, an organization in which all individuals have an opportunity to contribute something.
>
> ~Dewey, 1938/1997

Introduction

The purpose of Chapter One is to describe the Interactive Mathematics Review Program (IMRP) of the present action research study developed by the teacher-researcher that focuses on student preparation for algebra courses. Many ninth- and tenth-grade students at Cymax High School (CHS, pseudonym), a southern, low-socioeconomic status (SES) high school, struggle with learning the concepts of algebra because the dominant pedagogy at this school is teaching by rote memorization, an outdated strategy. Students enter high school unprepared to meet the demands of credit bearing mathematics curriculum. Two-thirds of the student-participants included in this research study have failed at least one previous mathematics course. Of these ninth- and tenth-grade students, two are 17 and three are over 18 years of age. With one or many previous academic failures, older students are often embarrassed and intimidated when they must be included in classes with younger students. For these reasons, student-participants enroll in remedial level courses with negative perceptions of learning mathematics. There is an interconnection between students' feelings and perceptions and their ability to understand the concepts presented, specifically in disciplines like mathematics and science (Udo, Ramsey, Reynolds-Alpert, & Mallow, 2001). Additionally, one research study conveys that an inverse correlation may exist between anxiety and academic performance (Kaya & Yildirim, 2014). For all of these remedial-level learners, the method of teaching is vital for student success and placing these learners at ease so they may reach their maximum learning potential in order to become successful in mathematics. Kaya and Yildirim (2014) contend that previous unpleasant learning experiences as well as instructional activities that are inconsistent with the learner's level of cognitive development may increase anxiety. The needs of remedial students should be assessed prior to the beginning of coursework in order to prepare and improve these students' chances for success.

Further, high failure rates are increasing in entry-level mathematics courses as rigor in state academic standards increase. Students who are not motivated are often left behind. This is certainly true when students are fearful of repeating a course and uncertain of their future. Careful consideration should be given to designing curriculum in concert with student-participants' perceptions that encompass creative ideas to improve student learning. Levine (1983) asserts, "The typical classroom has a strongly evaluative atmosphere because of a reward system based on academic performance" (p. 29). In particular, peers and the environment of the classroom may be important factors to determine self-concept of the individual student. Pedagogical practices that engage students in hands-on, active learning such as CL instruction can appeal to the interests of students (Kaya & Yildirim, 2014). Johnson, Johnson, and Smith (2007) convey that students who learn in cooperative groups are provided increased opportunities to become stronger as they begin to perform individually.

Research Literature to Substantiate the Need for Engagement in Mathematics

Today, highly valued pedagogical practices of algebra are moving into a new realm of student-centered inquiry (Walters et al., 2014). As South Carolina mathematics students progress toward more rigorous content outlined by the South Carolina College- and Career-Ready Standards (SCCCR, 2015), it will be important to find creative ways to differentiate instruction and engage students in the process of their learning. As difficulty increases in mathematics academic standards, more students fall behind. Slavin (1999) asserts, “Cooperative learning is one of the greatest success stories in the history of educational innovation” (p. 74). Hundreds of research studies support the success and positive effects on academic achievement for students of all levels of ability when cooperative learning (CL) is properly implemented (e.g., Felder & Brent, 2007; Johnson et al., 1981; Slavin, 1999).

According to Chapman and King (2012), “Students and teachers benefit from differentiated assessment because data gathered from various sources provide a metaphoric mosaic of each student’s readiness for learning specific skills or topics” (p. 10). In this study, the teacher-researcher designed an IMRP to enable Intermediate Algebra students to gain an in-depth understanding of math concepts in order to be successful in mathematics. Schul (2011) conveys, “A common misunderstanding of cooperative learning is the belief that any type of group work is cooperative learning” (p. 88). CL activities assign each student-participant tasks within the activity to hold them accountable to the group and create structured interdependence among members (Smith et al., 2005).

The IMRP designed for the Intermediate Algebra course at a large suburban high school consisted of 25 CL activities for the teacher-researcher to gain knowledge of students' perceptions and was implemented during the spring of 2017. Additionally, the program enabled student-participants to build an in-depth understanding of specific SCCCR (2015) standards. Each activity lasted between one and two class periods of 80 minutes. Of the students enrolled in the two Intermediate Algebra courses, 9 out of 21 had a learning disability or received accommodations through special education. Jolliffe (2007) explains, "Cooperative learning requires pupils to work together in small groups to support each other to improve their own learning and that of others" (p. 3). Many students, even those with learning disabilities, have found increased success with difficult concepts through CL. Through CL strategies, students from all levels and varying abilities can benefit (Slavin, 1999). Differentiated instruction strategies are beneficial to every student.

Emerson (2013) asserts:

> Students with disabilities are more engaged in classroom activities where cooperative learning structures are in place compared to more traditional classroom interventions. Specifically, in inclusive classes that use cooperative learning, students articulate their thoughts more freely, receive confirming and constructive feedback, engage in questioning techniques, receive additional practice on skills, and have increased opportunities to respond. (p. 1)

See Chapter Two for a more detailed discussion of scholarly literature.

Problem of Practice (PoP) Statement

The identified problem of practice for the present action research study involves ninth- and tenth-grade student preparation for remedial mathematics courses at a southern suburban high school. The year before the study, the majority of these entry-level students began the year with remedial courses to meet the demands of their credit-bearing mathematics courses. High failure rates in entry-level mathematics courses continue to grow (see Appendix A). According to CHS Mathematics Department (2016) data, 31% of students at CHS enrolled in the Foundations in Algebra course did not pass (CHS Foundations in Algebra Teachers, personal communication, October 25, 2016). Large class sizes often dominate remedial level courses.

The concepts of mathematics (i.e., in this study algebra) are cumulative, and a foundation of knowledge from previous classes is essential to be successful in subsequent classes. Students who have discontinuity of knowledge are not able to perform mathematics concepts at the next level. Using CL strategies to improve student learning of algebraic concepts allows students to build a solid foundation of skills in order to be successful in their current class and higher mathematics classes as well. Over the 2015-2016 school year, CHS documented a large increase in failure rates among ninth-grade students in algebra (see Appendix A). Many students arrive as ninth graders with little interest in math, low self-esteem, and few of the necessary skills to be successful (CHS Mathematics Department, personal communication, October 25, 2016). Therefore, the teacher-researcher has designed a review program for ninth- and tenth-grade students to enable them to meet some of the challenges they face in high school.

Background of the PoP

McKernan (1988) asserts that action research is "a form of self-reflective problem solving, which enables practitioners to better understand and solve pressing problems in social settings" (p. 6). In this high school of almost 2,000 students, teachers are having difficulty meeting the high demands of large class sizes. Students who are not motivated are often left behind. Failure rates are already high in these lower-level courses as students enter high school unprepared to meet the demands of credit-bearing mathematics curriculum.

In 2015, the South Carolina Department of Education (SCDE) implemented new mathematics academic standards. These new standards and courses are designed to prepare students for higher education and the real world. The problem is closing the gap on achievement when failure rates are already too high. Every student in high school must become proficient in writing recursive and explicit formulas, describing the effects of transformations from the parent function, understanding radical functions, solving quadratic functions with complex solutions and more (SCCCR, 2015, pp. 93-94). Students will no longer be able to memorize concepts. Every student must understand concepts and apply them in order to be successful in their mathematics courses and earn a high school diploma.

Research Question

The research question in this study established the need for greater understanding and intentional investigation of ninth- and tenth-grade students' perceptions of an IMRP designed to enable those students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research in order to improve student learning and collect data: “What are ninth-grade and tenth-grade remedial mathematics students’ perceptions of an Interactive Mathematics Review Program?”

Research Objectives

Johnson and Johnson (1999a) describe five elements of CL as positive interdependence, accountability, building interpersonal skills, promotive interaction, and group processing. Egalitarian principles were found within the review of literature (Kagan, 2014), which provide additional support to CL instruction as a sixth element. These served as the six objectives of the IMRP that the participant-researcher developed for ninth-grade and tenth-grade Intermediate Algebra students and for this action research study. Many struggling algebra students complain that they are “terrible math students,” that they “don’t understand math concepts,” or that they generally “do not like math.” As an algebra teacher, the teacher-researcher designed the IMRP to enable students to be open-minded to learning algebra in a completely new way.

The first objective of the program and of this action research study was to create interdependent groups among these entry-level students who work well together. When CL was introduced, these students learned to appreciate constructive criticism with some type of praise for effort. The participant-researcher monitored groups to ensure positive collaboration was occurring. When collaboration was not positive, the participant-researcher intervened through redirection and in some instances altered the group members for the next activity.

A second objective of the IMRP was accountability as measured by informal assessments. For example, every member of the cooperative group had individual responsibilities for every lesson and each was required to demonstrate and share his or her learning responsibility throughout the learning activity. Maintaining small groups of two to three members ensures accountability for every student-participant.

A third objective was development of interpersonal skills or social skills through communication that these students will need in their future careers and in life. CL instruction promotes positive social interaction between team members. The climate of the classroom has been altered because the heterogeneous groups comprised two to three members and each had to participate. Cooperation assists with building positive relationships through collaboration. The participant-researcher has built a rapport with her Intermediate Algebra students and determined the best possible academically and culturally diverse teams to build cohesive units for instruction. Through observation, the teacher-researcher assigned group members and carefully monitored the groups via recording field notes and memoing and in a participant-researcher's journal.

A fourth objective was promotive interaction. Promotive interaction is sharing ideas, and supporting and encouraging each member of the group during CL activities. Promoting the success of other student-participants improves cognitive connections of present and past learning as well as assists group members by supporting social skills necessary to complete activities. With any constructive feedback, students also received praise for effort (Johnson, Johnson, & Holubec, 1993). Active learning through CL activities promotes greater understanding of concepts, requires students to demonstrate a process, and increases motivation (Slavin, 1995).

A fifth objective was group processing. Students could reflect on individual lessons for what went right and what needed improvement. Reflection is vital throughout every learning experience for students and the teacher. Data are organized so that they can be carefully assessed and evaluated. This is specifically important for the research to make improvements for the subsequent cycle (Johnson & Johnson, 1999).

The final objective was to promote egalitarian principles. Each group member was required to participate and given an individual task to reach the unified goal. For example, each group had a student who described the solution to the problem and one who recorded the solution. In groups of three students, one student was assigned to summarize the process and record the information. After each question, the students alternated roles. In this way, each member had an opportunity to lead and communicate through verbal and written language.

Statement of Purpose

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a professional learning community (PLC) at CHS in order to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance.

Scholarly Literature Establishing a Framework for Progressive Education and CL Theory

This qualitative action research study is grounded on the theories of progressive education and CL theory. Dewey (1916) asserts, "Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional noting of connections; learning naturally results" (p. 181). Dewey (1916) believed in the movement toward progressive education where learning naturally results through students' formative experiences. He believed that children should learn through active participation in instruction. His research implies that student motivation would increase if the lessons were relevant to the students' interests. Dewey promoted CL where the student would create a deeper cognitive connection through small group, kinesthetic instruction. Rousseau (1762/1979) believed in progressivism where students are not submissive learners but rather learn through active participation and being engaged in activities. The teacher serves to develop activities that guide students through natural exploration using his/her senses in order to learn. Pestalozzi (1912) contended that a child who learns through memorization is not able to go on to difficult mathematical skills until he/she understands the concepts.

CL Theory is addressed by Slavin (2014). The theorist asserts that CL can transform a classroom "from remedial to advanced" (p. 26). Research has shown that students from all levels and varying abilities may benefit from CL strategies (Slavin, 1999). Johnson and Johnson (1999) defined CL as small group instruction where students are active participants, which results in increased understanding of concepts. Kagan (2014) contends that every student can be successful when CL instruction is implemented.

Johnson, Johnson, and Smith (2007) convey, "The purpose of cooperative learning is to make each member a stronger individual…. Students learn together so that they can subsequently perform higher as individuals" (p. 23). Building on this theory, the present study explored the relationship between CL groups and increased ninth-grade student understanding in algebra. The course was an Intermediate Algebra math course where most students were unprepared to meet the rigorous demands of the high school's math curriculum. Due to increased failure rates, an IMRP was designed for CHS, and specifically for this action research project, to enable students to work within cooperative groups in order to maximize their learning potential.

Johnson et al. (1981) convey:

> The overall effects stand as strong evidence for the superiority of cooperation in promoting achievement and productivity…. Given the general dissatisfaction with the level of competence achieved by students in the public school system, educators may wish to considerably increase the use of cooperative learning procedures to promote higher student achievement. (p. 58)

In this study, CL assisted the participant-researcher to arrange specific interactions for students placed in small, heterogeneous groups to acquire knowledge through application of metacognitive skills and reflect for improvements in subsequent activities (Johnson, Johnson, & Holubec, 1993; Kagan, 2001; Slavin & Madden, 1989). Establishing a CL environment maximizes the learning potential of each student and allows the individual to overcome obstacles of the activity and gaps in the foundation of knowledge, content vocabulary, motivation; brainstorm multiple ways to solve a problem; and move past failures that present low self-esteem and normal difficulties of living within a low-SES environment. Slavin and Madden (1989) describe an at-risk student as one who may not acquire the necessary skills and educational goals to be successful in life.

In remedial classes such as Intermediate Algebra, differentiated instruction using techniques like CL is necessary for all students to achieve mastery of standards. These remedial-level students can become engaged in CL activities, which promotes greater understanding of concepts in order to be higher-achieving, successful math students.

Key Concepts/Glossary of Terms

Action Research: any methodical inquiry conducted by teachers or anyone vested in the teaching or process of the learning environment with the purpose of collecting information about the individual operation of their school, their pedagogical practices, or learning practices of their students (Mills, 2011).

Accountability: Every group member has value and a responsibility to the other group members to complete their share of the work (Gillies, 2007).

Active Learning: learning where students are engaged in the process of doing and then reflecting on the activities they are doing (Bonwell & Eison, 1991).

Algebra: “any of various systems or branches of mathematics or logic concerned with the properties and relationships dealing with abstract entities (such as complex numbers, matrices, sets, vectors, groups rings or fields) manipulated in symbolic form under operations often analogous of those of arithmetic” (Merriam-Webster, 2017).

Collaboration: The process of working with others to accomplish a task or goal (Gillies, 2007).

Egalitarian Principles: Following or supporting the idea that all people should have equal rights (Collins English Dictionary, 2017).

Interpersonal skills: Social skills that require the ability to communicate and interact with other people and deal with conflicts to accomplish the given task (Gillies, 2007).

Positive interdependence: Mutual reliance among members of a group that impact members in a positive way. In a CL environment, the team is successful only if all members achieve the goal (Gillies, 2007).

Positive relationships: "A direct relationship between two variables in which as one increases, the other can be expected to increase" (Medical Dictionary, 2017).

Potential Weaknesses

The first potential weakness is that the participant-researcher had no previous experience conducting the research. The research study was a work in progress. The concepts of this qualitative action research study were discovered by reading as many books, manuals, and other forms of previously conducted research as possible in a short three-year period. In order to analyze data, the constant comparative method (CCM) was used to describe, conceptually code, and categorically organize the collected data to generate the emerging themes (Glaser & Strauss, 1967; Mertler, 2014). There were countless hours studying this research and many nights with little sleep while reading and rereading the collected data.

Time was a second potential weakness. The participant-researcher was limited to time after the school day to transcribe, code, and complete further analysis as well as write this dissertation. Fortunately, the participant-researcher's family responsibilities could be put aside for the necessary 8 weeks in order for these actions to occur. It was a highly challenging time in the participant-researcher's life.

Finally, there is always the potential for some researcher bias as the participant-researcher got to know and love her students. The participant-researcher truly wanted them to be successful and worked extremely hard to help them develop great understanding of content. She worked tireless hours creating unique activities while trying to allow them to have a voice in the learning process. Since the CCM was used to generate emerging themes, these processes occurred simultaneously.

Significance of the Study

The research study is significant because it directly impacts the lives of these students. Two years prior to the research, the participant-researcher was asked by administration to develop a review program (in the form of an IMRP) for students who were failing math at CHS. It was at that point when she discovered the high failure rates for remedial level courses. Students wanted to quit school because they were unprepared to meet the demands of high school's rigorous standards and credit-bearing courses. It was not until the influence of CL instruction that the program was highly successful. In research studies conducted by Johnson and Johnson (1998, 1999a, 1999b, 2009) and Slavin (1999, 2014), the majority of students were successful. This research has the potential to change the lives of the students. The first implication of this research is that the IMRP can improve student learning, even for those students with learning disabilities. A second implication is that the IMRP promotes social justice where all students are equal in every CL activity. The IMRP is a success story for improving remedial students' perceptions of learning mathematics. Only 7 of the 21 students had passed all previous math classes. The IMRP promotes increases comprehension of math concepts, increases engagement and math-related discussions, increases motivation to complete assignments, promotes egalitarian principles and establishes high-quality reciprocity. Student 10B stated, “My people think like I think. Sometimes teachers do not understand the questions I am asking. I like learning like this.” Through the IMRP, a special education student became successful in the regular math classroom. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students become social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). Students, “no longer only concentrated on their own learning but instead shared their mathematics understanding with their team members as well as their other classroom peers” (2016, p. 119). Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), “Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students” (p. 101). The findings are similar to previous research by Sherrod, Dwyer, and Narayan (2009), which conveys, “performing these activities, students are nurtured in an environment that supports them in constructing a more comprehensive understanding of mathematics” (p. 255).

The IMRP promotes social justice. Through this action research study, every student was provided equal opportunities to learn and have a voice in the classroom. Every student was accountable and participated in every lesson. A Black female and a Black male had the highest grades in both classes. In the 2017-2018 school year they will both be placed in higher math and on the college preparatory track. Student 2A transitioned from completing all assignments with a resource teacher to completing all assignments in the classroom, including summative assessments. She earned straight A's for both nine weeks, a student of the quarter award, and an end of the year award for highly improved. She had never been truly successful in math. Her mother was astonished. Students from all levels and varying abilities benefit from CL strategies (Slavin, 1999).

Rationale

The intention of this study was to develop an IMRP to enable struggling math students to learn algebra in a cooperative setting. The action research methods utilized for conducting the research, need for implementation of the IMRP based upon CL formative assessments, and contributions of the study to the existing body of knowledge are presented in this chapter. The need for more research on the effects of CL instruction in secondary education is expressed in several previous research studies (Slavin, 1989/1990; Slavin, 1981; Whicker, Bol, & Nunnery, 1997). Few related research studies have been conducted in secondary mathematics classrooms. Through application of CL groups for mathematics instruction, students become more actively engaged in the process of learning than through the traditional teacher-centered approach. The expectation of this action research study was for the participant-researcher to gain an understanding of students' perceptions of CL instruction and for student-participants to develop a deeper understanding of the required math standards in order to be successful in their present mathematics course and throughout high school.

The SCCCR Mathematical Process Standards (2015) describe the minimum requirements that students should meet to advance to the next level. The SCCCR (2015) standards state that the primary concern of the individual learner is to maintain persistence, reason theoretically, improve critical thinking skills, apply mathematics to practical applications of real-world concepts, and recognize patterns to interpret their meaning, which will assist understanding of concepts in mathematics (pp. 90–91).

According to the SCCCR (2015) standards:

> Since the process standards drive the pedagogical component of teaching and serve as the means by which students should demonstrate understanding of the content standards, the process standards must be incorporated as an integral part of overall student expectations when assessing content understanding. (p. 7)

CL groups were chosen to promote metacognition and strengthen mathematics skills. There is evidence in research to support that students develop a deeper understanding and increased retention of concepts when CL instruction is used (Johnson, Johnson, & Smith, 2007; Slavin, 1995). They are able to build a stronger foundation of necessary skills and use these skills beyond the classroom, either in the workforce or in higher education.

Conceptual Framework

Kagan (2001) asserts that during the 1960s, CL was initiated as a new strategy in the American education system. Initially small, collaborative groups were used to improve the performance of unprepared students, and it is still applicable today. The guiding belief is that humans are naturally social and enjoy positive interactions especially among a diverse population. Since that time many different strategies have developed but they all remain with a common goal to improve student learning.

The teacher-researchers' strong belief is that every student has the ability to learn the skills necessary to graduate. Helping students believe in themselves and value education has been a great obstacle. The ideology embraced in this study is that meaningful content and relevant learning experiences will increase student motivation and build a stronger desire to learn. This is necessary as educators introduce more rigorous content in the coming years. A second belief is that strong positive feedback for every student will increase performance in the classroom. The positive comments should be immediate and sincere. Students will work diligently when they know you care about them as individuals. For some students, a high school diploma is simply a stepping-stone to higher education. For others, it has become the single gateway to every employment opportunity in the real world. Several of our 2015 graduates were the first members of their families to graduate from high school.

Action Research Methodology Summary

This study employed an action research design involving the implementation of CL instruction to assess students' perceptions that lead them to gain an understanding of mathematics so that they become successful in algebra. A qualitative approach was used to collect and analyze data. Qualitative data collection included semi-structured interviews, field notes of student observations, learning artifacts, surveys, and a focus group interview (see Appendices B and C). Quantitative Likert surveys were also collected to polyangulate and strengthen the analysis of data (see Appendix C). Mills (2011) asserts that journals are a continual process for teachers "to systematically reflect on their practice by constructing a narrative that honors the unique and powerful voice of the teachers' language" (p. 86).

An IMRP was developed by the participant-researcher to enable her struggling students to learn algebra in a cooperative setting. In addition to mathematics concepts, the program included instruction developing the following: (1) positive interdependence; (2) accountability; (3) building interpersonal skills; (4) promotive interaction; (5) group processing; (Johnson & Johnson, 1999a) and (6) egalitarian principles (Kagan, 2014). The IMRP was developed for the Intermediate Algebra classroom and followed the principles of action research for a period of 8 weeks. Students were placed in small heterogeneous groups of two to three members. Each group received CL formative activities as they worked toward a common goal. Every group member added value and participated in activities through a given task. Through CL groups, students were able to discuss concepts with a peer similar to their own level of development and understanding. Mertler (2014) asserts that continual reflection for improvement is necessary for each step in the process. After each day of CL, the teacher determined what changes should be implemented and reflected upon improvements for each activity in a participant-researcher's journal. Careful thought was given to provide each student-participant a task for each CL activity to ensure that each member worked cooperatively and participated. The teacher-researcher provided positive reinforcement and praise even if the student was not successful. This established clear guidelines for a CL structure and for the study to become cyclically applied in future semesters.

This study implemented qualitative action research in order to provide an in-depth understanding of students' perceptions of the IMRP. The participant-researcher was interested in how to manipulate instructional methods to improve student learning. Four students, two male and two female, were interviewed at three points in time. Detailed field notes and memoing were used to describe specific details of student observations. Learning artifacts including classwork and homework were collected through a coding process to protect the anonymity of each student-participant. Reflection notes were kept in the participant-researcher's journal.

To reduce the risk of confounding variables in relation to gender, the researcher ensured that all groups were heterogeneous. Student-participants were of similar abilities because only Intermediate Algebra students within two classrooms were the focus of this action research study. The action research design is strong because: (1) student interviews provided a detailed account of student understanding, (2) a participant-researcher journal enabled reflection on each CL activity in order to improve pedagogical practices, and (3) student surveys and a focus group interview captured detailed information that may have been otherwise missed.

CL strategies can positively impact students' perceptions so that they will build a foundation of knowledge in order to become successful in algebra. Through positive interaction with others, students are engaged in activities during every CL lesson. Research has shown that students from all levels and varying abilities can benefit from CL strategies (Slavin, 1999). CL groups were chosen to promote metacognition and strengthen mathematics skills. Because of the design of this qualitative action research study, every student has the potential to be successful.

The primary purpose of the present study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a PLC at CHS to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance. CL instruction has shown to have a positive impact across gender, socioeconomic status (SES), at-risk conditions, learning difficulties, and even behavioral issues. Every student can achieve success through CL instruction when it is implemented properly through a variety of engaging activities (Slavin, 1999).

The research question of this study was: “What are ninth-grade and tenth-grade remedial math students’ perceptions of an Interactive Mathematics Review Program?” In order to answer the research question, the researcher gained an understanding of the variables involved in the study. These variables include gender of participants, age, level of performance, selection bias, proper sample size, school size, attendance, student attitudes, and behavioral issues. According to the United States Department of Education’s Mathematics Advisory Panel, “Of particular importance is determining the variables that impede or facilitate transfer. Studies of transfer suggest that people’s ability to make links between related domains is limited; studies on how to foster transfer in key mathematical domains are needed” (Faulkner et al., 2008, p. 30).

The researcher created 25 formative assessment lessons that implement the six elements of CL instruction: positive interdependence, accountability, promotive interaction, building interpersonal skills, and group processing (Johnson & Johnson, 1999). Egalitarian principles were found within the review of literature (Kagan, 2014), which provide additional support to CL instruction as a sixth element. Four formal interviews were conducted at three points in time with two male and two female student-participants (see Appendix B). The four formal interviews were conducted with the same four students in order to monitor and assess growth for in-depth understanding of algebraic concepts over the 8-week study. Additional students were questioned during instructional activities to capture specific students' perceptions for improving student learning. The questions asked in the semi-structured interviews provided insights into students' perceptions of the IMRP. Observations as the participant-researcher or questions that arose from field notes were included. As their current classroom teacher for Intermediate Algebra, the researcher has built a rapport with her students. Instead of simply answering their questions, the teacher typically uses inquiry questions to guide them during every lesson. All of the techniques that are used for CL are used every day in the classroom. Interviews were not audiotaped due to the extreme discomfort of two interviewees and the potential to stifle openness of responses. All interviewees were comfortable with paper and pencil note taking.

Students also had access to technology through the use of district-issued iPads, which assisted students in becoming more engaged in the lessons while investigating concepts. Technology helps students make practical application connections to concepts and increases student engagement in the process. At a minimum, students improve their oral communication, leadership skills, and writing ability for mathematics. The participant-researcher monitored accountability of the individual students and reflected on the effectiveness of each strategy implemented. Once the study was completed, the participant-researcher analyzed and synthesized data for reporting purposes.

All CL groups were designed to be academically and culturally diverse. Groups were of similar abilities because only Intermediate Algebra students were the focus of the study. The action research design was strengthened because: (1) student interviews provided a detailed account of student understanding, (2) a participant-researcher journal allowed for reflection of each CL activity in order to improve pedagogical practices, (3) surveys and a focus group interview allowed the participant-researcher to capture detailed information that may have been otherwise missed, and (4) polyangulation occurred through cross-referencing qualitative and quantitative data.

CL strategies can positively impact students' perceptions so that they will build a foundation of knowledge in order to become successful in algebra. Through positive interaction with others, students are engaged in activities during every CL lesson. Research has shown that students from all levels and varying abilities can benefit from CL strategies (Slavin, 1999). This is specifically important to the study because the high school is situated in a low-SES environment, which is evident through the 40% free and reduced lunch rate, according to High Schools (2015) data. CL groups were chosen to promote metacognition and strengthen mathematics skills. Because of the design of the study, every student could be successful.

This action research study designed an IMRP with progressive pedagogy to enable students to understand how to work in CL groups to improve student learning of algebraic concepts. The main reason for utilizing collaborative groups is to allow students to learn in cohesive units so that they become stronger and perform greater as individuals. The study explored the relationship between CL groups and increased student understanding. CL has shown to positively impact student learning. Research has indicated that students with varying levels of ability can become successful when these pedagogical practices are properly implemented (Slavin, 1999).

The fundamental question of this study was: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?" In order to answer the research question, the researcher had to understand and identify all variables involved in the study. The independent variable is method of teaching, which in this study will be CL strategies. The dependent variables are students' perceptions and student learning outcomes. There are many variables involved in the study including gender of participants, age, level of performance, selection bias, proper sample size, time management, school size, attendance, student attitudes, and behavioral issues. According to the United States Department of Education's Mathematics Advisory Panel (2008), "Of particular importance is determining the variables that impede or facilitate transfer. Studies of transfer suggest that people's ability to make links between related domains is limited; studies on how to foster transfer in key mathematical domains are needed" (Faulkner et al., 2008, p. 30).

Action Research Methodology

Action Research Philosophy

The teacher-researcher believes in progressive education where learning naturally results through students' formative experiences (Dewey, 1916), and that teachers should create student-centered CL opportunities where students are working through activities in order to learn concepts and make connections to the real world. CL is not new to education and dates back to the theories of John Dewey (1916) and the movement toward progressivism. Dewey's (1916) idea of CL was to create a deeper cognitive connection through experience; student motivation would increase if the lessons were relevant to the students' lives. He believed that his kinesthetic style of learning would prevent rote memorization of facts and foster a deeper understanding of material for every student. Dewey (1916) asserts that a shared experience in learning provides greater understanding:

> By conjunction with other factors in activity, the sound [of the word] soon gets the same meaning for the child as it has for the parent; it becomes a sign of the activity into which it enters. The bare fact that language consists of sounds which are mutually intelligible is enough of itself to show that its meaning depends upon connection with a shared experience. (p. 18)

This research will build upon the ideas of progressivism, since the researcher believes that student-centered learning produces in-depth understanding and greater achievement than more traditional methods such as direct instruction. When students are engaged in activities associated with learning, students should develop a better understanding of the concept and retain information longer. This idea is especially important for mathematics because every subsequent class builds upon the concepts of previous ones. The progressivist's classroom is a student-centered classroom emphasizing individual needs, concerns, and experiences of learners.

The progressivist student is a critical thinker and real-world problem solver who learns to think collectively as a team member and autonomously as well. Every student is a valued member of a small group and has a responsibility in his or her own learning process. This may be the first time in an at-risk student's life that being a valued member of a group has occurred. Improving student learning and greater understanding of concepts are the central ideas for developing the learning activities. Curriculum content is designed so the student will gain knowledge through experiences. Through their learning activities, students can develop new ideas through inquiry and questions that they answer. In this way, their knowledge is expanded through deep explorations and critical thinking. The progressivist teacher is simply one who prepares and guides engaging curriculum. His or her role is to keep students focused on their activities while allowing them to gain a deep understanding and mastery of mathematical skills.

Research Question

The research question established the call for greater understanding and intentional investigation of ninth- and tenth-grade students' perceptions of an IMRP designed to enable those students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher in narrowing the focus of the research and collecting data: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?"

Participant Selection

The action research study was implemented during the spring semester of 2017 with 21 students enrolled in two Intermediate Algebra classes. CHS (2016) data showed that 48% of the students enrolled in the participant-researcher's two Intermediate Algebra course received free or reduced lunch. The participant-researcher is not allowed access to specific names of students enrolled in the program. Additionally, 75% of the student-participants have failed at least one previous math course. So most of these students have negative perceptions for learning mathematics. These students are typically 15 to 16 years of age, however, two are 17 and three are over 18 years of age. Students are of similar abilities because they are in the same level mathematics course. Every student provided consent and a desire to be placed into the study.

In middle block Intermediate Algebra, there were 4 male and 4 female students of which 5 are Black, 1 is Hispanic, 1 is American Indian, and 1 is White. In fourth block, there were 4 males and 10 female students of which 9 are White, 3 are Black, and 1 is Hispanic. Only 7 of the 21 students have been successful in all previous math courses. One student-participant completed the previous course through credit recovery. Credit recovery is an opportunity to earn credit for a course due to failure only if the range of the grade is between 50 and 59 at completion of the course. The student is required to complete extra activities on a computer or district-issued iPad and is allowed approximately 2 weeks to complete all assignments. Additionally, one male student that has been successful in all previous math courses was in self-contained or special education math class until this year. Since this information does not appear on the students' transcript, the participant-researcher was unaware of this fact until she inquired about this students' slightly lower retention capacity of concepts learned at 5 weeks into the research. Additionally, 9 of the 21 students enrolled in the two Intermediate Algebra classes have a learning disability or receive special accommodation for learning mathematics. Three of these students have additional physical impairments. One student-participant is an English-language learner.

Research Site

The high school where the research was conducted is quite large, with approximately 2,000 students. It is situated in a rural area within a low-SES community.

According to the South Carolina Department of Education's Annual School Report Card (2013):

> The high school has about 10% of learners with disabilities and about 7% of the population is comprised of students who are older than usual for their grade level. Only about 53.8% of students will be eligible for LIFE scholarship upon graduation and 53.4% are participating in worked-based learning experiences. The ratio of students to teachers is approximately 26 to 1. The lower SES is confirmed by the fact that about 93% of our students receive subsidized meals. (p. 4)

Data Sources

To study CL strategies utilizing a qualitative research design, multiple data sources were collected. Qualitative data collected included semi-structured interviews, field notes of student observations, participant-researcher journal, learning artifacts, surveys, and a focus group interview. Qualitative data collection was polyangulated with quantitative Likert surveys in order to build a comprehensive account of information for improving pedagogical practices to reveal ninth- and tenth-grade remedial mathematics students' perceptions of an IMRP (Mertler, 2014; Mills, 2011). Including quantitative data in the form of Likert surveys provided a foundation to strengthen the research over qualitative alone. Yin (2009) argues that data are more persuasive and precise if they are polyangulated from "several different sources of information" (p. 116). Comparing data prepared the researcher to answer the research question and to provide in-depth information on students' perceptions for the mathematics review program in order to improve student learning of algebraic concepts.

The participant-researcher was interested in how to manipulate instructional methods to improve student-learning outcomes. The participant-researcher collected and analyzed both types of data to strengthen the study. Qualitative data are often used with direct interaction between individuals. For CL groups and the effect on student learning, qualitative data collection is effective in describing and providing a detailed account of the data.

Data Collection Methods

The first source of data was four semi-structured student-participant interviews at three points in the research (see Appendix B). Semi-structured interviews occurred after the first CL activity, at the midpoint of the research, and at the end of data collection. Two male and two female student-participants were interviewed. Interviews provided information on student performance and understanding of individual lessons. Interviews can alter the course of research through continual reflection for every student to benefit. Second, field notes including memoing and reflection notes captured students perceptions of CL. Third, questionnaires were used to gather other qualitative data that are necessary to improve instruction. Fourth, informal assessments such as observations, learning artifacts, and surveys were conducted for evidence of student learning outcomes. Fifth, a focus group interview was completed at the end of the data collection.

Summary of the Findings

The 21 student-participants were presented with 25 CL instructional activities during an 8-week period in the spring of 2017. Semi-structured interviews captured in-depth details about students' perceptions and feelings at three points in time (see Appendix B). Student self-evaluations and reflections as well as Likert surveys provided additional information of students' perceptions in order to polyangulate the data. Polyangulation is necessary because it allows the researcher to improve accuracy of data through cross-referencing (Mertler, 2014; Mills, 2011). All study participants, including the participant-researcher, continually reflected for improvements. Reflection was first accomplished by collecting self-evaluation and reflection surveys at beginning, middle, and end of the 8-week study. Second, student-participants applied metacognitive reflection and shared ideas for improvements to be made and for each activity to be successful. Third, the participant-researcher reflected throughout each activity in field notes through memoing. Finally, a focus group interview was conducted after all CL activities were completed. The participant-researcher disaggregated the data by gender and race.

Findings were that five overarching themes emerged: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) CL involves egalitarian principles; and (5) CL encourages high-quality reciprocity. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students became social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016). Students, "no longer only concentrated on their own learning but instead shared their mathematics understanding with their team members as well as their other classroom peers" (2016, p. 119). Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), "Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101). The findings are similar to previous research by Sherrod, Dwyer, and Narayan (2009), which conveys, "performing these activities, students are nurtured in an environment that supports them in constructing a more comprehensive understanding of mathematics" (p. 255).

Conclusion

The objective of creating this CL environment was to increase engagement, understanding of concepts, growth, and ultimately passing rates in entry-level algebra courses among ninth- and tenth-grade remedial mathematics students. The SCCCR standards are aligned with CL strategies in a linear path through theory, previous research, and practice. From the time of John Dewey (1916) and Lev Vygotsky (1980) to present, many research articles have explored CL strategies and the results display improved learning. Individual CL strategies such as brainstorming, think-pair share, peer-led team learning, individualized group learning with technology, and sage and scribe activities at a minimum provide greater understanding of individual concepts (Kagan, 2001). This current research is unique because it focuses on entry-level secondary mathematics students in secondary education, where the foundation of mathematical concepts is vital to growth and passing rates.

Dissertation Overview

A qualitative action research design was selected to improve pedagogical practices and student learning at CHS. This research study builds upon the conceptual framework of progressive education and CL theory in order to improve understanding of mathematical concepts. Therefore, the present action research study is delineated by the following statements: (1) to build a mathematics review program for students to become successful in Algebra, and (2) to explore students' perceptions of learning in order to improve pedagogical practices in the mathematics classroom thereby improving student learning.

The dissertation presented is structured by chapters in the following manner: In Chapter One, the problem of practice describes that students enter high school unprepared to meet the demands of credit-bearing mathematics curriculum. High failure rates impact entry-level mathematics courses (see Appendix A). Students who are not motivated are often left behind. A mathematics review program was needed for ninth- and tenth-grade student preparation for remedial mathematics courses at this southern working-class high school. The fundamental question of this study in order to improve student learning was formulated from these problems: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?" To answer this question completely, a conceptual framework of support was established.

Chapter Two establishes a conceptual framework in order to build a platform for the participant-researcher to create student-centered CL opportunities where students worked through activities to learn concepts. CL instruction is outlined by the following six objectives: positive interdependence, accountability, building interpersonal skills, promotive interaction, group processing (Johnson & Johnson, 1999), and egalitarian principles (Kagan, 2014). The curriculum theory presented in this dissertation models the ideas of Dewey (1916), Rousseau (1762), and Pestalozzi (1912).

Chapter Three presents the methodology that guided the research, with an overview of the problem of high failure rates in entry-level courses due to increased rigor in mathematics standards. Data collection occurred during an 8-week period in the spring of the 2016-2017 school year with 21 student-participants. The IMRP was implemented to improve student-learning experiences and capture in-depth details about students' perceptions in order to answer the research question completely for improving student learning. Qualitative data collection served as the primary data source in the form of field notes from observations, semi-structured interviews, student's self-evaluation and reflection surveys, student artifacts, and a focus group interview. Quantitative data from Likert surveys were collected as a secondary source in order to polyangulate the data (Mertler, 2014; Yin, 2009).

Chapter Four displays the findings and implications of this action research project. Findings were that five core themes emerged: (1) CL instruction promotes increased comprehension; (2) CL instruction increases engagement and math-related discussions; (3) CL increases motivation; (4) CL promotes egalitarian principles; and (5) CL promotes high-quality reciprocity. Implications are that the IMRP can improve student learning for every student, even those with learning disabilities. Additionally, the IMRP promotes social justice by holding students accountable and creating equal opportunities to learn as well as lead. Every student can become successful if CL strategies are properly implemented. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students become social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119).

Chapter Five concludes and summarizes this action research study. The final chapter presents key questions that emerged during the research, challenges that occurred, and the researcher's positionality statement as an insider and an outsider in the research. Also presented is an action plan to continue the research for refinement and improvements, how this research is facilitating educational change, and suggestions for future research. References and appendices follow Chapter Five.

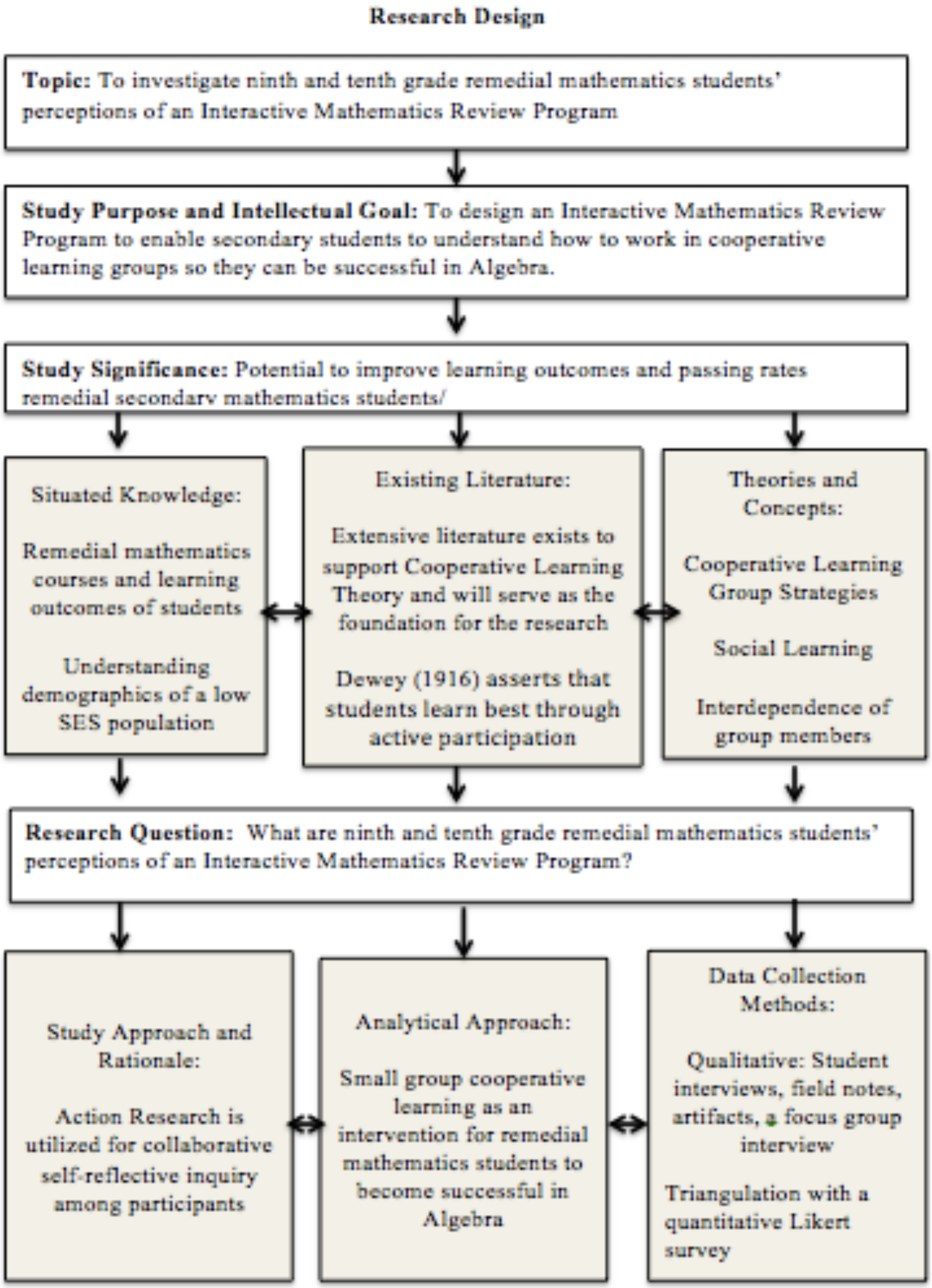

Figure 1.1. *Research Design*

CHAPTER TWO: LITERATURE REVIEW

> Cooperative learning instruction as compared to individual efforts, more often results in greater achievement, increased retention of concepts learned, higher-level critical thinking skills, greater perseverance to remain on task despite difficulties in order to accomplish goals, greater understanding of one's own thought processes, and greater capacity for logical thought in transfer of learning experiences. (Johnson, Johnson, & Smith, 2007, p. 19)

Introduction

The purpose of Chapter Two is to chronicle previous theories related to cooperative learning (CL) and present a detailed account of the impact of CL on teaching and student learning. This qualitative action research study draws heavily upon the philosophies that promote CL opportunities where students learn through experiences. The curriculum theory presented in this dissertation models the ideas of influential theorists promoting progressive education and CL Theory.

Progressive Education. Dewey (1916) believed in the movement toward progressive education where learning naturally results through students' formative experiences. He believed that children should learn through active participation in instruction. His research implies that student motivation would increase if the lessons were relevant to the students' interests. The teacher only serves to guide instruction. Dewey promoted CL where the student would create a deeper cognitive connection through small group, kinesthetic instruction. Dewey (1916) asserts, “Give the pupils something to do, not something to learn; and the doing is of such a nature as to demand thinking, or the intentional notion of connections; learning naturally results” (p. 181). Rousseau (1762/1979) believed in progressivism where students are not submissive learners but rather learn through active participation and being engaged in activities. The teacher serves to develop activities that guide a student through natural exploration using his/her senses in order to learn. Pestalozzi (1912) contended that a child who learns through memorization is not able to go on to more difficult mathematical skills until he/she understands the concepts.

Cooperative Learning Theory. Johnson and Johnson (1999a) defined CL as small group instruction where students are active participants, which results in increased understanding of concepts. They convey five objectives of CL: (1) positive interdependence; (2) accountability; (3) building interpersonal skills; (4) promotive interaction; and (5) group processing. Kagan (2014) emphasized the importance of equal participation in learning where every student benefits from instruction. His research provided insight to establish a sixth objective for this research study, (6) egalitarian principles. He contends that every student can be successful when CL instruction is implemented.

In this study, CL assisted the participant-researcher to arrange specific interactions for students placed in small, heterogeneous groups to acquire knowledge through application of metacognitive skills and reflect for improvements in subsequent activities (Johnson, Johnson, & Holubec, 1993; Kagan, 2001; Slavin & Madden, 1989). Establishing a CL environment maximizes the learning potential of each student and allows the individual to overcome obstacles of the activity and gaps in the foundation of knowledge, content vocabulary, motivation; brainstorm multiple ways to solve a problem; and move past failures that present low self-esteem and normal difficulties of living within a low-SES environment. Slavin and Madden (1989) describe an at-risk student as one who may not acquire the necessary skills and educational goals to be successful in life.

The strategy for searching for literature to complete the literature review in this action research study was to follow the theorists and leaders of both progressive education and CL instruction. Schramm-Pate (2014) described the theorists of progressive education among others. The participant-researcher decided to explore the research associated with those principles and examined CL instruction as connected to progressive education. There are hundreds of studies that exist on the success of CL to improve student learning (e.g., Felder & Brent, 2007; Johnson et al., 1981; Slavin, 1999). To prepare this dissertation, a multitude of books, peer reviewed journal articles and other resources were examined and utilized. Further research was needed on the effects of CL in secondary education (Slavin, 1995).

Problem of Practice (PoP) Statement

The identified problem of practice (PoP) for the present action research study involves ninth- and tenth-grade student preparation for remedial mathematics courses at a large suburban high school located in a low-SES environment. In 2016, the majority of these entry-level students began the year with remedial courses to meet the demands of their credit-bearing mathematics courses. Even then, failure rates among these children were high. According High Schools (2015), 40% of the students enrolled in Cymax High

School (CHS) received free or reduced lunch. Further, 48% of students enrolled in the study's Intermediate Algebra course received free lunch. This information places those students in a possible at-risk state. Every student deserves an equal opportunity to learn and be successful even with increasing rigor of academic standards.

The concepts of mathematics (i.e., in this study algebra) are cumulative, and a foundation of knowledge from previous classes is essential for success in subsequent classes. Students who have discontinuity of knowledge are not able to perform mathematics concepts at the next level. Using CL strategies to improve student learning of algebraic concepts allows the student to build a solid foundation of skills to be successful in their current class and higher mathematics classes as well. Over the 2015-2016 school year, CHS documented a large increase in failure rates among ninth-grade students enrolled in algebra (see Appendix A). The participant-researcher requested and received data from each Foundations in Algebra teacher for 2016 failure rates (CHS Foundations in Algebra Teachers, personal communication, October 25, 2016). Approximately 31% of students enrolled in the entry-level prerequisite mathematics course did not pass (see Appendix A). Many students arrive as ninth graders with little interest in math, low self-esteem, and few of the necessary skills to be successful according to standards of the high school (CHS Mathematics Department, personal communication, October 25, 2016). Therefore, the participant-researcher designed a review program (in the form of an IMRP) for ninth- and tenth-grade students to enable them to meet some of the challenges they face in high school and improve student learning in the process.

Background of the PoP

McKernan (1988) asserts that action research is “a form of self-reflective problem-solving, which enables practitioners to better understand and solve pressing problems in social settings” (p. 6). In this high school of almost 2,000 students, teachers are having difficulty meeting the high demands of large class sizes, based on conversations within math department meetings. Students who are not motivated are often left behind. Failure rates are already high in these lower-level courses as students enter high school unprepared to meet the demands of a credit-bearing mathematics curriculum.

In 2015, the South Carolina Department of Education (SCDE) implemented new mathematics academic standards. These new standards and courses are designed to prepare the student for higher education and the real world. The problem is closing the gap on achievement when failure rates are already too high. Every student in high school must become proficient in writing recursive and explicit formulas, describing the effects of transformations from the parent function, understanding radical functions, solving quadratic functions with complex solutions, and other difficult algebraic concepts (SCCCR, 2015, pp. 93-94). Students will no longer be able to memorize facts. Every student must understand and apply concepts in order to be successful in their mathematics courses and earn a high school diploma.

Research Question

The research question established the need for greater understanding and intentional investigation of ninth- and tenth-grade students’ perceptions of an Interactive Mathematics Review Program (IMRP) designed to enable these students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research to improve student learning and collect data: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?"

Statement of Purpose

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a professional learning community at CHS to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance.

Points of View

CL instruction was chosen over methods that employ competition or individual learning because the learning supports care and concern among group members and equality for all learners. Johnson and Johnson (1982) convey that their study "provides behavioral evidence that cooperative learning experiences did in fact promote more cross-ethnic interaction during instruction than did competitive or individualistic learning experiences" (p. 55). In another research study, Johnson and Johnson (2001) contend that considerable research exists where CL instruction as "compared with competitive and individualistic ones, result in promotive interaction (as compared with oppositional and no interaction) which in turn result in greater effort to achieve, more positive interpersonal relationships, and greater psychological health" (pp. 22-23).

Collaborative Group Learning

Thirty-five years ago, the main purpose of utilizing collaborative groups was to allow students to learn in cohesive units so that they became stronger and improved their performance as individuals, according to Johnson et al. (1981). Building on this theory, the present study explored the relationship between CL groups and increased ninth-grade student understanding of algebra. The course was an Intermediate Algebra math course where most students were unprepared to meet the rigorous demands of the high school's math curriculum. Due to increased failure rates, an IMRP was designed for CHS, and specifically for this action research, to enable the students to work within cooperative groups in order to maximize their learning potential.

Johnson et al. (1981) convey:

> The overall effects stand as strong evidence for the superiority of cooperation in promoting achievement and productivity…. Given the general dissatisfaction with the level of competence achieved by students in the public school system, educators may wish to considerably increase the use of cooperative learning procedures to promote higher student achievement. (p. 58)

In remedial classes such as Intermediate Algebra, differentiated instruction using techniques like CL is necessary for all students to achieve mastery of standards. These remedial-level students can become engaged in CL activities, which promotes greater understanding of concepts in order to be higher achieving, successful math students.

Research Objectives

Johnson and Johnson (1999) describe five elements of CL as positive interdependence, accountability, building interpersonal skills, promotive interaction, and group processing. Egalitarian principles were found within the review of literature, which provides additional support to CL instruction as a sixth element (Kagan, 2014). These will serve as the six objectives of the IMRP that the participant-researcher developed for ninth-grade and tenth-grade algebra students for this action research study.

Many struggling algebra students complain that they are “terrible math students,” that they “do not understand math concepts,” or that they generally “do not like math.” The participant-researcher developed the IMRP to enable her students to be open-minded to learning algebra in a completely new way. The first objective of the program and of this research was to create interdependent groups among these 21 Intermediate Algebra students who worked well together. When CL was introduced, these students learned to appreciate constructive criticism with some type of praise for effort. The participant-researcher monitored groups to ensure positive collaboration was taking place. When collaboration was not positive the participant-researcher intervened through redirection and in some instances altered the group members for the next activity.

A second objective of the IMRP was accountability as measured by informal assessments. For example, every member of the cooperative group had individual responsibilities for every lesson and each was required to demonstrate and share his or her learning responsibility throughout the instructional activity.

A third objective was development of interpersonal skills or social skills through communication, which these students will need in their future careers and in life. CL instruction promotes positive social interaction between group members. The climate of the classroom was altered because the heterogeneous groups were comprised of two to three members and each had to participate. Cooperation assists with building positive relationships through collaboration. The participant-researcher has built a rapport with her Intermediate Algebra students and determined the best possible groupings to build cohesive units for instruction. Through observation, the teacher assigned group members and carefully monitored the groups via notes in a participant-researcher's journal and through memoing.

A fourth objective was promotive interaction. Promotive interaction is sharing ideas, supporting and encouraging each member of the group during CL activities. Promoting the success of other student-participants improves cognitive connections of present and past learning as well as assists group members by supporting social skills necessary to complete activities. With any constructive feedback, students also received praise for effort (Johnson, Johnson, & Holubec, 1993). Active learning through CL activities promotes greater understanding of concepts, requires students to demonstrate a process, and increases motivation (Slavin, 1995).

A fifth objective was group processing. Student-participants should reflect on individual lessons for what went right and what needs improvement. Reflection is vital throughout every learning experience for students and teachers. Data are organized so that they can be carefully assessed and evaluated. This is specifically important for the research to make improvements for the subsequent school cycle (Johnson & Johnson, 1999b).

The final objective was to promote egalitarian principles. Each group member had an equal voice and was required to participate. Each group member was given an individual task to reach the unified goal and had an equal opportunity to lead the group. For example, each group had a student who described the solution to the problem and one who recorded the solution. In groups of three students, one student was assigned to summarize the process and record the information. After each question, the students alternated roles. In this way, student-participants developed leadership and communication skills through verbal and written language.

Purpose of Literature Review

The purpose of this literature review is to establish a conceptual framework to serve as a foundation for building an IMRP. A literature review is vital because it provides justification for the research to be conducted. Through the literature review, in combination with experience and background, the teacher-researcher has gained an understanding of the body of knowledge of CL strategies that exists from prior research. This provided the participant-researcher with in-depth knowledge on strategies utilized as well as appropriate techniques for providing instruction for these Intermediate Algebra students. This participant-researcher extended previous research through expansion of ideas for small group instruction. Guiding principles from previous research supported the current research and methods that were implemented.

Researching these previous methods also allowed the participant-researcher to avoid making similar mistakes through repetitive research. The overall goal of this literature review was to provide a foundation of support to study the impact of CL on student learning outcomes. Gender and race were included in the data collection to begin and strengthen the research throughout the process.

Boote and Beile (2005) describe the importance of the literature review:

> To advance our collective understanding, a researcher or scholar needs to understand what has been done before, the strengths and weaknesses of existing studies, and what they might mean. A researcher cannot perform significant research without first understanding the literature in the field. (p. 3)

Hart (1999) discusses that in addition to developing a greater understanding of the topic, the researcher learns how the previous research was conducted, the main theories surrounding the topic, and the specific problems or questions that have encompassed the previous research.

Standards included play a key role in understanding the importance of a literature review. In this case, it was important that the literature review become a single coherent segment to support the research regarding the effects CL has on students' perceptions of an IMRP and assisting them to gain an understanding of concepts of mathematics. Boote and Beile (2005) describe criteria for inclusion in the literature review as adapted with permission from Hart (1999):

(1) Rationale for literature that is included or excluded with reasoning so that the topic is thoroughly investigated but not too broadly. This criterion is specifically important to the research and places the responsibility "on the doctoral candidate to convince the audience that inclusion has been purposeful" (p. 7).

(2) The literature review is synthesized. The participant-researcher is able to critically examine and differentiate the current research from previously conducted research and expand upon it. In this study, the existing problem underlying the research involving ninth- and tenth-grade student preparation for remedial mathematics courses at a large suburban high school in a low-SES environment fits into the scholarly research that previously existed. A thorough history of the topic has been investigated which had an impact on the relevance of the research conducted and was utilized for support and correlation. The history of the topic provides direction for the study to be completed and an Action Plan to be created so the study may become cyclical for improvements to be made. Specific vocabulary relevant to the topic is identified and definitions are included in this chapter. A relationship between the variables of CL instruction and students' perceptions and learning outcomes is clearly described as the research was conducted. New relationships are outlined or formed. The review of literature regarding CL instruction and the research itself become a coherent whole and new ideas are established as a result.

(3) A complete analysis of theories is incorporated that extends beyond a simple description.

(4) Previous research chosen was valid and reliable.

(5) A strong, foundational body of knowledge is written as a cohesive unit to support and direct the current investigation to be conducted.

This literature review of CL strategies associated with students' perceptions is to explore the original perspectives of previous researchers along the lines of the current research. Once the study was completed, the researcher reinvestigated those studies that followed the original research and adjustments were made. Importance was placed upon notes recorded in the participant-researcher's journal for opposition of theorists, observations of successes, and analysis of failures. The literature review served as a blueprint to guide and direct the way for the new research to be conducted.

Themes of Cooperative Learning Theory

The first theme is the benefits of CL instruction for all students with different levels of ability. Students from all levels and varying abilities benefit from CL strategies (Slavin, 1999). The Intermediate Algebra classroom is composed of students with a variety of levels of ability from special needs to advanced levels. CL instruction has shown to have a positive impact across gender, SES, at-risk conditions, learning remediation, and even behavioral concerns (Slavin & Madden, 1989). A second theme explored is student motivation. Nichols and Miller (1993) convey that motivation increases through CL instructional strategies if properly implemented. Remedial students often lack motivation especially when the concepts of learning become challenging. They simply give up. A third theme this dissertation explored from previous research is increased student achievement. Kagan (2001) conveys that CL instruction can increase academic achievement. Since CHS has documented alarming failure rates among remedial mathematics classes, this theme was necessary to be explored.

Primary Sources

John Dewey (1916) and his ideas on progressive education served as a primary foundation for the design of this research. Dewey believed that children should learn through active participation in instruction. He did not agree with teacher-led direct instruction and rote memorization but firmly believed that students should learn by doing. His many writings convey his beliefs that learning should be meaningful and relevant to students' lives. Of primary importance are Dewey's (1916, 1997, 2009) works related to his original *Democracy in Education* and *Experience and Education*.

Rousseau's (1762/1979) *Emile, or on Education* provides insight into the history of educating the whole child and the developmental process of the student.

Johann Heinrich Pestalozzi's (1912) *Pestalozzi's Educational Writings (Educational Classics)* provide the history of education and served as support for the research to be conducted. His ideas made sense of how to improve education for children and provide greater understanding into how students learn. Pestalozzi was an education reformer and an advocate for educating the poor.

Lev Vygotsky influenced the design of the research. His ideas portrayed that learning should be accomplished through social interaction but he also believed that culture played an important role in learning. Because the research site is situated in a diverse population from a low-SES environment, his ideas are significant to the research being conducted. Vygotsky's (1980) book, *Mind in Society: The Development of Higher Psychological Processes*, influences this research.

Roger Johnson and David Johnson (1998, 1999a, 1999b, 2009) provide a foundation of CL research articles and books. In current CL research, they serve as the foundation for almost every recent research article or book. Johnson and Johnson (2009) convey, “The importance of emphasizing cooperative learning in classrooms goes beyond just achievement, positive relationships, and psychological health” (p. 9). Their research articles and books serve as groundwork to build the design.

Boote and Beile (2005) have provided primary research on preparation of a literature review and its importance to the preparation of research. Boote and Beile’s (2005) article, “Scholars Before Researchers: On the Centrality of the Dissertation Literature Review in Research Preparation,” has assisted the researcher with the knowledge that a literature review is essential to planning and designing educational instruction strategies for at-risk students.

Kagan (2001) has been a dominant force to promote CL in the classroom. Kagan’s (2001) book, *Cooperative Learning Structures Can Increase Student Achievement*, provided support and guidance for the research design. The researcher attended one of his sessions at the Southern Regional Education Board’s High Schools That Work conference in 2014. His ideas that students retain information longer when they receive positive affirmation for their work was included in this research and may have strong implications for the focus population being studied.

Gillies’ (2007) book, *Cooperative Learning: Integrating Theory and Practice,* provided additional instructional strategies and CL activities to influence the research positively. Her work defined many key terms to explain implications for the research to take place.

Mertler’s (2014) book, *Action Research: Improving Schools and Empowering Educators* (4th ed.), served as the foundation for planning and designing this action research study. Mertler (2014) has provided in-depth understanding into action research principles and has guided the participant-researcher to design and prepare this dissertation.

The SCCCR Standards for Mathematics (2015) served as a primary source because it was necessary to align every cooperative strategy with the standards as required by law. With increased rigor of these standards for mathematics, they permeate through every lesson and the goals of mastery were in the forethought of the research.

Nichols and Miller's (1993) research, *Cooperative Learning and Student Motivation*, served as additional information on strategies of CL. Nichols and Miller's (1993) results supported their beliefs that, "working in cooperative groups leads to higher levels of self efficacy" (p. 18).

Schwalbach's (2003) *Value and Validity in Action Research: A Guidebook for Reflective Practitioners* provided additional insight into a thorough design for the action research conducted in this study. The research was not limited to these primary sources. Additional resources were added as the research was being designed and conducted.

Secondary Sources

South Carolina Department of Education's (2013) *State of South Carolina Annual School Report Card* served as a supplementary source because it provides additional relevant information about the focus population and the environment in which they live. The research site is defined through this report as well as previous grades from each of the core disciplines in prior years.

Davis (1993) provided additional strategies and teaching techniques to expand the research from her book, *Tools for Teaching*. Her experience in teaching and techniques for being effective with differentiated instruction assisted the researcher when preparing activities to improve student learning.

Phillips and Burbules' (2000) book, *Postpositivism and Educational Research,* provided insight into other research that exists into the optimal learning environment for students.

Paulson and Faust's (2008) research, *Active Learning for the College Classroom,* was an additional resource on how students learn actively. Paulson and Faust (2008) convey that a student who participates in active learning instruction "…boosts critical thinking skills and fosters social interdependence and support among students" (p. 20). Since this research is not of primary focus to the current research to be conducted, it served as a secondary source of information.

Schramm-Pate's (2005, 2014) *Lectures: Knowing the Learner and Schooling and Society* served as additional support for the research to be conducted. Schramm-Pate's (2005, 2014) lectures gave insight into understanding the history and ideas of teaching and learning as well as provided guidance into how the current research should be established. Additional research was added to answer the research question completely in order to improve student learning.

Review of Literature Methodology

This study employed an action research design involving implementation of CL instruction to assess students' perceptions that lead them to gain an understanding of mathematics so that they become successful in algebra. A qualitative approach was used to collect and analyze data. Qualitative data collected includes semi-structured student interviews, field notes of student observations in a participant-researcher's journal, learning artifacts, surveys, and a focus group interview.

Qualitative data collection was polyangulated with quantitative Likert surveys in order to build a comprehensive account of information and improve pedagogical practices to improve student learning and create an IMRP for ninth- and tenth-grade remedial mathematics students (Mertler, 2014; Mills, 2011). Including quantitative measures through triangulation of data may better prepare the researcher to answer the research question to provide in-depth information on the overall success of differentiated instruction for student learning outcomes thereby improving student learning. Yin (2009) argues that data are more persuasive and precise if they are polyangulated from "several different sources of information" (p. 116).

The study began with implementation of CL instructional activities to capture students' perceptions of the mathematics review program to improve student learning of algebraic concepts. Students were placed in CL groups of two to three students. Each student had responsibilities for every lesson and the responsibilities were outlined in the instructions for individual activities. Students were able to make real-world connections to mathematics during every CL lesson. Students also had access to technology through the use of district-issued iPads, which assisted students in becoming more engaged in the lessons while investigating concepts. Technology will help students make real-world connections and make deeper connections to concepts. At a minimum, students could improve their oral communication, leadership skills, and writing ability for mathematics. The teacher monitored accountability of each individual student and reflected on the effectiveness of each strategy implemented.

This study implemented qualitative action research in order to provide in-depth understanding of the research problem.

Kemmis and McTaggert (1987) convey:

> Action research is a form of collective self-reflective enquiry undertaken by participants in social situations in order to improve the rationality and justice of their own social or educational practices, as well as their understanding of those practices and the situations in which the practices are carried out. Groups of participants can be teachers, students, principals, parents, and other community members – any group with a shared concern. The approach is only action research when it is collaborative, though it is important to realize that action research of the group is achieved through the critically examined action of individual group members. (p. 6)

The participant-researcher is interested in how to manipulate instructional methods to improve student-learning outcomes. Qualitative interviews serve as a great indicator to measure and improve student performance. The researcher collected and analyzed other qualitative data through formative assessments to strengthen the study further. For CL groups and the effect on students' perceptions, qualitative data collection may be the best way to describe the data. In this study, those qualitative data sources include semi-structured student interviews, field notes of student observations in a participant-researcher's journal, learning artifacts, surveys, and a focus group interview.

Fraenkel and Wallen (2003) describe the role of the teacher-researcher:

> The task of science is to discover the nature of this reality and how it works. A related emphasis is on breaking complex phenomena down into manageable pieces for study and eventual reassembly into the whole. The researcher's role is that of a "disinterested scientist," standing apart from that which is being studied, with his or her biases and values excluded through experimental design and control. (p. 424)

Slavin and Madden (1989) describe an at-risk student as one who may not acquire the necessary skills and educational goals to be successful in life. At-risk students may include low-SES conditions, poor attendance, those who have been retained by grade level, students with behavioral issues, and ones who have been identified with deficiencies in reading, writing, or mathematics. The authors convey that well-planned and organized instructional activities are the most effective for at-risk students. Additionally, the teacher-researcher understands that a great difference exists between basic group work and structured, CL group activities that are closely monitored. The teacher provides detailed observations of these activities that are independent of more traditional methods of instruction. This supports the research because CL is student-centered learning where every student is actively involved in the learning process.

Ideas pertaining to at-risk students are specifically important to this study because they fill in gaps and expand the previous research. Because the high school is made up of approximately 40% free/reduced lunch individuals and Intermediate Algebra is considered a remedial class, the knowledge of at-risk students applies to these students. These at-risk students may often choose to quit or be impassive about the low achievements they have seen in the past. Their new goals overcome those preconceived ideas because with CL activities every student can be successful. The study specifically examined students at-risk of failure in order to improve their growth and achievement.

Mertler (2014) describes that continual reflection for improvement is necessary for each step in the research process. After each day of CL, the teacher should determine what changes should be implemented. Careful thought should determine if all team members worked well together. The teacher provides an adequate amount of positive reinforcement and praise even if the students are not successful. The students gain a realization that in-depth learning occurs through making mistakes as well as from being successful in activities and in life. The teacher establishes relatively short time increments for answering questions and determines if improvement on the time frame for completion is needed. This connects to the current research because it establishes clear guidelines for student-centered learning and for the study to become cyclically applied.

The fundamental question of this study was: "What are ninth-grade and tenth-grade remedial math students' perceptions of an Interactive Mathematics Review Program?" In order to answer this research question to improve student learning, the researcher must understand the variables involved in the study. The independent variable is method of teaching, which in this study is CL instruction. The dependent variables are students' perceptions and student learning outcomes. There are many additional variables involved in the study including gender of participants, age, level of performance, selection bias, proper sample size, time management, school size, attendance, student attitudes, and behavioral issues. According to the United States Department of Education's Mathematics Advisory Panel, "Of particular importance is determining the variables that impede or facilitate transfer. Studies of transfer suggest that people's ability to make links between related domains is limited; studies on how to foster transfer in key mathematical domains are needed" (Faulkner et al., 2008, p. 30).

Lieberman (2013) conveys that humans mentally desire to maintain and are motivated by social connections. For over two centuries the education system has grown to understand the importance of these social connections in learning. For this research, CL groups were chosen to promote metacognitive awareness and strengthen mathematics skills. Because of the design of the study, every student may be successful. In addition, CL strategies may positively impact student learning. Through positive interaction with others, students make practical application connections to mathematics during every CL lesson. Students from all levels and varying abilities benefit from CL strategies (Slavin, 1999). This is specifically important to the study because the high school is situated in a low-SES environment, which is evident through the 40% free and reduced lunch rate.

According to Jacques and Salmon (2006):

> Group interaction allows students to negotiate meanings, to express themselves in the language of the subject and to establish a more intimate and dialectical contact with academic teaching staff than more formal methods permit. It also develops the more instrumental skills of listening, careful reading, presenting ideas (both in speech and in writing), persuading, and teamwork, all qualities attractive to employers with their greater expectations of the graduates' ability to communicate. (p. 1)

The vast amount of research that is used to support this study suggests that inquiry-based CL may and usually will improve student learning if implemented correctly. Whether formal or informal methods are employed, research displays that every student can improve. CL has shown to have a positive impact across gender, SES, at-risk conditions, learning difficulties, and even behavioral issues. When CL groups are implemented properly through a variety of engaging activities, every student may achieve success. Through small group interaction, students are able to discuss concepts with a peer with understanding similar to their own level of development and understanding. Student motivation should increase as the individual works to help the group. Student attitudes about the value of academics should positively increase. The unified goal of this research is for every student to achieve success.

Delimitations

Delimitations through implementation of the study have been carefully observed and recorded. First, investigating ninth- and tenth-grade students in lower-level courses presents many challenges. There are distractions facing these students that are difficult to overcome. One example is more freedom to be with friends and interact with conversational technology in high school. Some of these students may have already given up on their effort to pass the mathematics course, especially if they have been unsuccessful in the past or are currently failing the course. Difficulties may arise with the newly employed small group setting. Positive social interaction is necessary for CL instruction to occur. The participant-researcher carefully monitored all student interaction to ensure that every student was a valued member of a productive group. Field notes were taken for continual reflection and improvement of small group activities. Additionally, students today are accustomed to instant gratification through direct instruction. The teacher-centered method often allows students to become lazy and receive answers without effort. Through the implementation of CL strategies, students may rebel against having to put forth great effort to learn.

Conceptual Framework

Progressive education and CL in small heterogeneous groups is the dominant focus of the research. It is the belief of the participant-researcher that teachers should create student-centered social learning opportunities where students are working through activities in order to strengthen their abilities, master concepts, and make connections to the real world. John Dewey (1916) and the movement toward progressivism paved the way for the current research even so many years after his writings were produced. Dewey's (1916) idea of CL was to create a deeper cognitive connection through an experience. His research implies that student motivation would increase if the lessons were relevant to the students' interests. His kinesthetic style of learning would prevent rote memorization of facts and foster a deeper understanding of the material for every student.

This research builds upon the ideas of progressivism, since the participant-researcher believes that student-centered learning produces in-depth understanding and greater achievement than more traditional methods such as direct instruction. When students are engaged in activities associated with learning, the students should develop greater understanding of the concepts and retain the information longer. This idea is especially important for mathematics because every subsequent class builds upon the concepts of previous ones. The progressivist's classroom is centered on individual needs, concerns, and experiences of learners.

Davis (1993) asserts:

> Students learn best when they are actively involved in the process. Researchers report that, regardless of the subject matter, students working in small groups tend to learn more of what is taught and retain it longer than when the same content is presented in other instructional formats. (p. 147)

The progressivist student is a real-world problem solver who learns to think independently and as a member of a team. Every student is a valued member of a small group who has a responsibility in his or her own learning process. Improving student learning and greater understanding of concepts are the central ideas for developing the learning activities. Curriculum content is designed so the student gains knowledge through experience. Through their learning activities, students may develop new ideas and questions that they also explore. In this way, their knowledge is expanded through deep explorations. The progressivist teacher is simply one who prepares and guides engaging curriculum.

In a CL environment, students become interdependent on their small group members. As they work toward their goals, each individual student is successful only if all members are successful. Every group member has value and participates in activities. This supports the research because every student participates in the activities of the group. Individual students learn team-building skills as they work toward a common goal. Students build relationships and improve communication skills that are needed for the real world.

Johnson and Johnson (1999b) describe the teacher's role as one who guides, manages time, and maintains engagement of the members throughout the lesson. The teacher should be well prepared with material to keep students on task. Students are placed in groups of two or three persons to maintain accountability of every member and ensure they have taken part in the activity. The teacher establishes clear directions and provides some discussion into groups for redirection as necessary. For every question, each student formulates his or her own answer, discusses that answer with members of the group, and listens to the discussion from other group members. Every group member has a voice. Discussion follows as the group comes together through a consensus to write a collective yet improved answer. At the end of each lesson, teachers should provide a summary of the goals and objectives of the lesson. This not only provides closure but better retention of the material.

In *An Educational Psychology Success Story: Social Interdependence Theory and Cooperative Learning,* Johnson and Johnson (2009) convey that, "The success of cooperative learning is largely based on its having a clear conceptual foundation and hundreds of validating research studies that point the way for operational procedures for practitioners such as teachers" (p. 366). There are very few other instructional strategies that have seen as much success as CL.

Johnson and Johnson (1999b) assert the five essential elements of CL:

1) *Positive interdependence*: Students form a single cohesive unit as a group. Each student depends on the other members of the group to accomplish the goals of the lessons to master the mathematics academic standards. Positive interdependence conveys that students will rely on each other to accomplish

the given tasks and in doing so there is a beneficial relationship between the students.

2) *Accountability*: Individually and as a team, students have responsibilities to themselves and to the group. The individual is responsible for completing their own portion of the assignment and the group is responsible for the success of every member. The teacher and members support and encourage each other. There is a moment of realization from every member of the group when students notice they have a responsibility to the group's overall success. At that time, motivation increases and the increased effort to be a part of the group aids in the learning process. The goal is to improve self-efficacy for every member.
3) *Promotive interaction*: Engagement through activities is amplified through interaction with others. In mathematics, this is specifically important because new material builds upon previous learning.
4) *Building interpersonal skills*: These are the skills used daily to interact with those around us. This is specifically important in a low-SES environment, as evidenced through the 40% free and reduced lunch rate, because home life may not equate to rules of society.
5) *Group processing*: Students should reflect on individual lessons for what went right and what needs improvement. Reflection is vital throughout every learning experience for students and teachers. Data are organized so that they can be carefully assessed and evaluated. This is specifically important for the

research to make improvements for the subsequent cycle or for the study to become cyclically applied.

6) Egalitarian principles were found within the review of literature (Kagan, 2014), which provides additional support to CL instruction as a sixth element.

When these six elements are properly implemented, the result is improved achievement and growth of the individual. CL instruction has shown to have a positive impact across gender, SES, at-risk conditions, learning remediation, and even behavioral concerns (Slavin & Madden, 1989).

According to Jolliffe (2007), CL is an instructional strategy where small groups use different social learning activities "to support each other to improve their own learning and that of others" (p. 3). Many students, even those with learning disabilities, have found increased success with difficult concepts through CL.

Emerson (2013) asserts:

> Students with disabilities are more engaged in classroom activities where cooperative learning structures are in place compared to more traditional classroom interventions. Specifically, in inclusive classes that use cooperative learning, students articulate their thoughts more freely, receive confirming and constructive feedback, engage in questioning techniques, receive additional practice on skills, and have increased opportunities to respond. (p. 1)

Nichols and Miller (1993) describe the implementation of CL strategies in their mathematics classes:

> The results of this initial investigation into the motivational factors influencing achievement in cooperative learning groups provide support for each of the hypotheses outlined. First, the use of cooperative learning groups (Team Assisted Individualization) resulted in higher Algebra II achievement than the traditional lecture method. (p. 15)

Secondly, the students who were actively engaged in the student-centered learning activities "were more learning goal oriented, and expressed greater intrinsic valuing of Algebra II" (p. 15). Lastly, CL fostered "higher levels of self-efficacy regarding Algebra II than students in the traditional class" (p. 15). Dweck and Leggett (1988) explain:

> Those [students] with learning goals were more likely to view effort as a means or strategy for activating or manifesting their ability for mastery. Here effort and ability are seen as positively related: Greater effort activates and makes manifest more ability. (p. 261)

The research of Dweck and Leggett (1988) indicates that students gained an awareness of the fact that all students, even students with greater ability, should work diligently toward a goal because greater effort produces increased understanding.

Research is cited throughout this dissertation to provide support and increased understanding of the implementation of this research. The literature greatly enhanced the researcher's knowledge of the topics provided in the study and enabled her to potentially explore new ideas that will aid students for improved learning opportunities, differentiated instruction, developmental strategies, and opportunities for improved achievement. The unified goal of the research is for every student to become successful in the participant-researcher's classroom.

Historical Context

Rousseau (1762) asserts:

> All that we lack at birth, all that we need…is the gift of education. This education comes to us from nature, from men, or from things…the use we learn to make of this growth is the education of men, what we gain by our experience of our surroundings is the education of things. (p. 12)

Rousseau (1762), like Pestalozzi (1912) and Dewey (1916) believed in educating the whole child. This philosophy believes that students are not submissive learners but rather learn through active participation. Students learn through being engaged in activities. In his book *Emile* (1762/1979), Rousseau (1762) discusses the importance of teaching children at every level of growth and development. His book is broken into five parts or divisions of the stages of the life of a child. During the first stage, Rousseau (1762) discusses the importance of parenting, specifically the mother, to aid in the emotional development of the child. In the second stage, he discusses how the growing child connects to the real world through experience. During this stage, the child expands upon his/her five senses to experience the world. When the senses are developed the child begins to reason and infer without having been taught how to do so because he/she has learned through experiencing the real world. In the third stage, Rousseau (1762) discusses the importance of learning some type of manual labor. He conveys that such manual labor jobs are arts and that two of the most important manual labor jobs are farming and carpentry. With manual labor, a child learns a strong work ethic and more precise measurements through hand-eye coordination. When a student learns to be precise, then he/she can make generalizations to concepts in math. In the fourth stage, the child is now strong and can reason and think critically about subjects.

Rousseau (1762) believes the fourth stage is the time when a child can truly understand the beliefs of religion. He believed that religion and the understanding of God should be discovered and not taught, as he did in all levels of teaching. In Rousseau's story, the final stage in the book is when Emile (1762) takes a wife, Sophy. This idea of natural stages of learning where the previous is vital to the subsequent stage transformed ideas about education. Rousseau's (1762) ideas are still being discussed today, centuries later. Pestalozzi (1912) continued these ideas of learning through experience and being engaged in activities. He agreed that students should learn through using the five senses.

Pestalozzi (1912) asserts:

> Education was not concerned with instruction simply, or even primarily. [Pestalozzi] was concerned to raise men from their present degradation to the level of humanity. It was not the poverty, which he saw around him which stirred his soul to its depths; it was the degraded lives the poor people led. Their shiftlessness, their want of purpose and initiative, their lack of human dignity, hurt him. All these things could be cured by a properly devised system of education. (p. 7)

Pestalozzi (1912) would do even more than his predecessors. He set up orphanages and conducted research through experiments. He discusses that a child who learns through memorization is not able to learn difficult mathematical skills until he/she understands the concepts.

Dewey (1938) continues the idea of learning through experiences. His idea of progressive education implemented the idea that teachers should create lessons where students would be able to grow and develop critical thinking skills. Dewey (1938) asserts:

> There is, I think, no point in the philosophy of progressive education which is sounder than its emphasis upon the importance of the participation of the learner in the formation of the purposes which direct his activities in the learning process, just as there is no defect in traditional education greater than its failure to secure the active cooperation of the pupil in construction of the purposes involved in his studying. (p. 51)

Many ideas have evolved from these progressive philosophies. Collaborative learning techniques have been designed to teach students of every level and all abilities. Smith, Sheppard, Johnson, and Johnson (2005) convey that teachers should serve only to prepare and guide lessons while students learn in autonomous, small teams. When social learning occurs, every team member benefits. These philosophies support the research conducted in this study because they discuss the positive effects of CL for improving student learning.

Vygotsky (1980) continues the argument of active learning when he states, “Classrooms must be places in which all children, as well as their teachers, are actively engaged in the teaching/learning process…. These shared experiences create zones of proximal development for all those involved, teachers as well as children” (Scrimsher & Tudge, 2003, p. 304). Vygotsky’s (1980) philosophy was that learning occurs through social interaction and activities of the environment surrounding the child and this would result in greater development than if the child learned independently. To Vygotsky (1980), learning is not simply gradual acquisition of knowledge, learning is “a complex dialectical process characterized by periodicity unevenness in the development of different functions, metamorphosis or qualitative transformation of one form into another, intertwining of external and internal factors and adaptive processes” (pp. 121-122).

Key Concepts/Glossary of Terms

This glossary presents common definitions of specific terminology used throughout mathematics textbooks, curriculum unit plans, South Carolina College- and Career-Ready Standards for Mathematics (2015), and CL instruction.

Academic standard: Individual statements of goals of the knowledge students should acquire by the end of the lesson or course (SCCCR, 2015).

Achievement: Measurement of growth or success established in the form of a learning goal through formative and summative assessments (Gillies, 2007).

Brainstorming: A CL strategy where roles are given to members of the group. The captain is a quick responder who prompts additional ideas for the team. The supporter is a student who encourages and provides support to the other members. Some research suggests that encouraging comments of praise promotes retaining the concepts longer. Another member promotes other members to build upon previous ideas. Lastly, a student records all interaction through ideas implemented (Kagan, 2001).

Collaboration: The process of working with others to accomplish a task or goal (Gillies, 2007).

Communication: Imparting information through an exchange of ideas in verbal or written language (Merriam-Webster, 2015).

Cooperative learning: A form of active learning where students learn in small groups to complete instructional activities and accomplish a common goal (Gillies, 2007).

Cooperative learning strategy: A small group learning activity where students work together to obtain a common goal in the learning process (Kagan, 2001).

Feedback: Teachers or peers provide information on an individuals' performance for a task or accomplished the goal of a CL activity in order for the student group to improve on the performance (Gillies, 2007, p. 32).

Formative assessment: Activities that provide feedback to the teacher and students on the success of mastery of standards of individual lessons that may alter the course of the "teaching and learning process" (Gillies, 2007, p. 247).

Group investigations: A CL strategy where students are placed into small groups to investigate problems. Higher-order critical thinking skills are necessary to complete the assigned work, which is often some type of group project (Kagan, 2001).

Group processing skills: Members of a CL group reflect on their performance to make adjustments in order to improve through a type of informal assessment using higher-order metacognitive skills (Gillies, 2007).

Individual accountability: Every group member has value and a responsibility to the other group members to complete their share of the work (Gillies, 2007).

Interaction: The direct effect that group members have on the other members as they communicate to accomplish the goals of the lesson (Gillies, 2007).

Interpersonal skills: Social skills that require the ability to communicate and interact with other people and deal with conflicts to accomplish the given task (Gillies, 2007).

Jigsaw strategy: Students are placed into CL jigsaw groups where they are numbered individually. Each number given to the student proceeds to a learning station with that number to become an expert on a topic before returning to the group to teach their newly learned expert knowledge (Kagan, 2001).

Learning disabilities: Difficulties that arise in the ability to learn new concepts, often in delayed development or lack of ability to pay attention (Gillies, 2007).

Learning goal: Established principles to target a desired result or mastery of a specific skill or objective (Johnson, Johnson, & Smith, 2014).

Mean: Finding the average of a number set by determining the sum of the set and then dividing by the number of values within the set (NGA & CCSSO, 2010a).

Metacognitive awareness: The process where learners recognize how they think and learn best through critical thought of their own strengths and weaknesses (Gillies, 2007).

Numbered heads together: Each of the students receives a number. The teacher provides a question for each group. The students work collaboratively to answer the question given to them. Then, the teacher calls out a group with a specific number where that student provides the answer. In this way, every student is accountable to the group and ready to answer (Kagan, 2001).

Objective: Educational goals of the knowledge students should acquire by the end of the lesson or course (Marzano & Kendall, 2006).

Peer-led team learning: A CL strategy originally designed to improve understanding in classes for college. This small-group learning strategy assists learners in the group to solve rigorous problems as a team. Students discuss questions and explain concepts to each another (Gosser, 2015).

Positive interdependence: Mutual reliance among members of a group that impact members positively. In a CL environment, the team is successful only if together all members achieve a common goal (Gillies, 2007).

Progressive education: A philosophy of social education promoted by Jean-Jacques Rousseau and John Dewey where learning is focused on the needs of individual students (Graham, 2005).

Rallytable or round table: A CL strategy that incorporates writing in the mathematics classroom. Students provide input to write collaboratively on a single piece of paper that is passed around the group members in a counterclockwise pattern so that each member will need to contribute to the learning process (Kagan, 2001).

Rigor: Challenging academic concepts where students work toward a greater understanding (NGA & CCSSO, 2010b).

Showdown: A CL strategy where approximately 10 learning activity cards are placed faced down and drawn from a deck in the center of the table. A team leader is assigned by the teacher-researcher at the beginning of the activity in the instructions. The leader turns over the top card to display the problem. Each student writes down the given problem and the leader signals to go. Each group member works to solve the problem. Then, when every member has finished the solution, the leader states, "showdown." Each member displays their answers and if they all match the supposition is that the answer is likely correct. If they are different, the group collectively decides on the correct answer (Kagan, 2001).

Social Interdependence Theory: Results of a problem of practice are socially influenced through mutual reliance with other group members (Johnson & Johnson, 2009).

Socioeconomic status (SES): Student's physical environments; low-SES environments are typically lower income and fewer opportunities to learn than comparison averages (Jensen, 2009, p. 8).

Student Teams Achievement Division (STAD): A CL strategy where students are assigned to small groups in order to solve problems and reach their highest level of understanding. Often the lessons are teacher-initiated and students receive some type of certificate for completion of assigned work (Kagan, 2001).

Summative assessment: Formal activities that provide feedback to the teacher and students on the success of mastery of standards of individual lessons, or a way to measure progress formally (Gillies, 2007).

Synthesize: In a literature review, to examine critically and distinguish current research from previously completed research to bring findings together into a single cohesive unit to serve the purpose of answering the research question (Boote & Beile, 2005).

Teammates consult: A CL strategy where students receive individual worksheets or problems. To begin, students place their pencils in the center of the table and discuss the first problem. Then, they take their pencils and individually answer each problem only after discussion. For subsequent questions, this idea is repeated until all problems are solved. Reflection is necessary to ensure each student understands the concepts (Kagan, 2001).

Think-pair-share: A CL strategy where the teacher poses a problem to the group members and they think first individually. After thinking through the problem, the students share their ideas with other group members. In the end, students share their final answers with the class (Kagan, 2001).

Zone of proximal development: According to Vygotsky (1980), the zone of proximal development is the exploration of what students can learn through social interaction and what they learn alone. Vygotsky (1980) believed that students' development was greater through social interaction and that the student would have greater achievement through working with peers.

Literature Review Topics

Action research as outlined by Mertler (2014) is a strategy to identify an area that needs improvement or a focus area, determine the method for data collection, analyze the data that have been collected to interpret meaning, and develop an action research plan for improvements to be made. CL may be summarized as small heterogeneous group instruction where students are active participants in order to increase understanding of concepts (Johnson & Johnson, 1998; Kagan, 2001). Johnson and Johnson (1999a) convey five elements of CL as positive interdependence, accountability, building interpersonal skills, promotive interaction, and group processing. Kagan (2014) provides a sixth objective using egalitarian principles. These serve as the six objectives of this research.

Social learning dates back to the ideas of John Dewey (1916) and the progressivist movement. Dewey (1916) states, "In undeveloped social groups, we find very little formal teaching and training" (p. 8). Dewey (1916) continues:

> Etymologically, the word education means just a process of leading or bringing up. When we have the outcome of the process in mind, we speak of education as shaping, forming, molding activity – that is a shaping into the standard form of social activity. (p. 12)

Progressivism originated as a movement that was initiated by social reformers toward a better society in response to the economic and social issues many were facing. Graham (2005) asserts that progressivism allowed students to be active participants where they learned by experiencing their lessons. The ideas of Dewey (1916) were closely associated with the progressivist movement.

Conclusion

Aristotle (2003) conveys, "To reach one's maximum potential and live an accomplished life, an essential element of the individual life should be education" (p. 35). As a teacher, one feels a great responsibility to provide the greatest individualized instruction to every student so that they may grow into well-rounded, responsible, productive members of society. The hope is that every student is successful in these courses and in life. Through CL strategies, students should become self-directed learners who take responsibility for their actions, self-assess, and redirect as necessary in order to find success. Although much research has proven the achievement gains of CL, little research has studied the impact of CL investigating a population of students at-risk of failing mathematics in a low-SES environment. This study is necessary to expand previous research theories of CL.

The focus of this study is to research and gain key insights on the relationships that exist between CL strategies and student outcomes. Johnson and Johnson (2009) convey, “Positive interdependence exists when there is a positive correlation among individuals’ goal attainments; individuals perceive that they can attain their goals if and only if the other individuals with whom they are cooperatively linked attain their goals” (p. 366). Using the ideas of previous research, a variety of strategies of CL were employed to see the greatest positive impact on student outcomes. This study provides key insights into teaching strategies that may be implemented in the entire high school population.

In CL instruction, students are required to contribute to the group, maintain focus, complete a task, assist one another to complete the task, encourage other group members, share collective ideas, become a critical thinker and real-world problem solver, provide results to other group members and the teacher-researcher, and accept feedback from other group members. Some of the CL strategies that were implemented in this study include sage and scribe, brainstorming, think-pair-share, peer-led team learning, and personalized group learning. Many aspects of this research such as additional CL strategies, mathematics lessons including active engagement of students, the impact on the social identities of 17- or 18-year-old students learning in the classroom with ninth-grade students, and improved student achievement in secondary education may provide further implications for research.

CHAPTER THREE: ACTION RESEARCH METHODOLOGY

> Without the cooperation of its members society cannot survive, and the society of man has survived because the cooperativeness of its members mad survival possible…. It was not an advantageous individual here and there who did so, but the group. In human societies the individuals who are most likely to survive are those who are best enabled to do so by their group.
>
> ~Montague, *The Human Revolution*, 1965

Introduction

The purpose of Chapter Three is to describe the qualitative action research design, which chronicles secondary students' perceptions of a cooperative learning (CL) model of instruction at Cymax High School (CHS). The focus of this research study was to observe and analyze the students' opinions, beliefs, and attitudes of an Interactive Mathematics Review Program (IMRP) developed by the participant-researcher. The IMRP was used to improve understanding of math concepts and thereby improve motivation, engagement, and achievement for remedial level ninth- and tenth-grade students. Marzano, Pickering, and Pollock (2001) identified CL as a research-based instructional strategy with "a high probability of enhancing student achievement for all students in all subject areas at all grade levels" (p. 7). In a previous study, students' perceptions were favorable toward learning mathematics due to participation in CL groups (Miller, 2003).

The participant-researcher completed a literature review synthesis, which revealed that CL instruction significantly improved student learning and promoted positive achievement results over traditional methods of individualistic instruction (Johnson, Johnson, & Holubec, 1993; Slavin & Madden, 1989). Researchers with extensive knowledge in the field of CL have assisted the participant-researcher to design an IMRP as well as CL activities that increase understanding of math concepts. CL is peer-to-peer instruction that builds positive social interaction for students of every level (Johnson & Johnson, 1999a; Kagan, 2001). CL instruction has shown to be positive across gender, SES, and those students who are considered at-risk (Slavin & Madden, 1989). Additionally, students who need learning remediation and students with behavioral concerns, benefit from this progressive pedagogy. The literature review greatly enhanced the researcher's knowledge of the topics provided in the study and explored new ideas that aided students to improve learning opportunities.

Problem of Practice (PoP) Statement

The identified problem of practice for the present action research study involves ninth- and tenth-grade student preparation for remedial mathematics courses at a large suburban high school in a low-SES environment. In 2016, the majority of these entry-level students began the year with remedial courses to meet the demands of their credit-bearing mathematics courses. Even then, failure rates among these children were high. According High Schools (2015), 40% of the students enrolled in CHS received free or reduced lunch. In this qualitative study, 10 out of 21 students enrolled in the current Intermediate Algebra course received free lunch.

The concepts of mathematics (i.e., in this study algebra) are cumulative and a foundation of knowledge from previous classes is essential for success in subsequent classes. Students who have discontinuity of knowledge are not able to perform mathematics concepts at the next level. Using CL strategies to improve student learning of algebraic concepts allows the student to build a solid foundation of skills in order to be successful in their current class and higher mathematics classes as well. Over the 2015-2016 school year CHS documented a large increase in failure rates among ninth-grade students in Intermediate Algebra (CHS Mathematics Department, personal communication, October 25, 2016). Approximately 31% of the students enrolled in an entry-level mathematics course did not pass (see Appendix A). Many students arrive as ninth graders with little interest in math, low self-esteem, and few of the necessary skills to be successful, according to the high school. Therefore, the participant-researcher designed a review program for ninth- and tenth-grade students to enable them to meet some of the challenges they face in secondary education.

Background of the PoP

McKernan (1988) asserts that action research is "a form of self-reflective problem-solving, which enables practitioners to better understand and solve pressing problems in social settings" (p. 6). In this high school of almost 2,000 students, teachers are having difficulty meeting the high demands of large class sizes, based on conversations within math department meetings. Students who are not motivated are often left behind. Failure rates are already high in these lower-level courses as students enter high school unprepared to meet the demands of credit-bearing mathematics curriculum.

In 2015, the South Carolina Department of Education implemented new mathematics academic standards. These new standards and courses are designed to prepare the student for higher education and the real world. The problem teachers face is closing the gap on achievement when failure rates are already too high. Every student in high school must become proficient in writing recursive and explicit formulas, describing the effects of transformations from the parent function, understanding radical functions, solving quadratic functions with complex solutions, and other difficult algebraic concepts (SCCCR, 2015, pp. 93-94). Students will no longer be able to memorize facts. Every student must understand and apply concepts in order to be successful in mathematics courses and earn a high school diploma.

Research Question

The research question established the need for greater understanding and intentional investigation of ninth- and tenth-grade students' perceptions of an IMRP to enable these students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research to improve student learning and collect data: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?"

Statement of Purpose

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a professional learning community at CHS in order to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance.

Collaborative Group Learning

Thirty-five years ago, the main purpose of utilizing collaborative groups was to allow students to learn in cohesive units so that they became stronger and improved their performance as individuals, according to Johnson et al. (1981). Building on this theory, the present study explored the relationship between CL groups and increased ninth-grade student understanding in algebra. The course was an Intermediate Algebra math course where students were unprepared to meet the rigorous demands of the high school's math curriculum. Due to increased failure rates, an IMRP was designed for CHS and specifically for this action research project to enable the students to work within cooperative groups in order to maximize their learning potential.

Johnson et al. (1981) convey:

> The overall effects stand as strong evidence for the superiority of cooperation in promoting achievement and productivity…. Given the general dissatisfaction with the level of competence achieved by students in the public school system, educators may wish to considerably increase the use of cooperative learning procedures to promote higher student achievement. (p. 58)

In remedial classes such as Intermediate Algebra, differentiated instruction by using progressive pedagogical techniques like CL is necessary for all students to achieve mastery of standards. These remedial-level students can become engaged in CL activities which promote greater understanding of concepts in order to be higher-achieving, successful math students.

Research Objectives

Johnson and Johnson (1999a) describe five elements of CL as positive interdependence, accountability, building interpersonal skills, promotive interaction, and group processing. Egalitarian principles were found within the review of literature, which provides additional support to CL instruction as a sixth element (Kagan, 2014). These served as the six objectives of the IMRP that the participant-researcher developed for ninth-grade and tenth-grade algebra students and for this action research study.

Many algebra students complain that they are "terrible math students," that they "do not understand math concepts," or that they generally "do not like math." The participant-researcher developed the IMRP to enable her students to be open-minded to learning algebra in a completely new way. The first objective of the program and of this action research was to create interdependent groups within this group of Intermediate Algebra students who worked well together. When CL was introduced, these students learned to appreciate constructive criticism with some type of praise for effort. The participant-researcher monitored groups to ensure positive collaboration was taking place. When collaboration was not positive the participant-researcher intervened through redirection and in some instances altered the group members for the next activity.

A second objective of the IMRP was accountability as measured by informal assessments. For example, every member of the cooperative group had individual responsibilities for every lesson and each was required to demonstrate and share his or her learning responsibility throughout the instructional activity.

A third objective was development of interpersonal skills or social skills through communication that these students will need in their future careers and in life. CL instruction promotes positive social interaction between group members. The climate of the classroom was altered because the heterogeneous groups were comprised of two to three members and each had to participate. Cooperation assists with building positive relationships through collaboration. The participant-researcher built a rapport with her Intermediate Algebra students and determined the best possible groupings to build cohesive units for instruction. Through observation, the teacher assigned group members and carefully monitored the groups via recording notes and memoing in a participant-researcher's journal.

A fourth objective was promotive interaction. Promotive interaction is sharing ideas, supporting and encouraging each member of the group during CL activities. Promoting the success of other student-participants improves cognitive connections of present and past learning as well as assists group members by supporting social skills necessary to complete activities. With any constructive feedback, students also received praise for effort (Johnson, Johnson, & Holubec, 1993). Active learning through CL activities promotes greater understanding of concepts, requires students to demonstrate a process, and increases motivation (Slavin, 1995).

A fifth objective was group processing. Student-participants should reflect on individual lessons for what went right and what needs improvement. Reflection is vital throughout every learning experience for students and teachers. Data were organized so that they could be carefully assessed and evaluated. This is specifically important for the research to make improvements for the subsequent cycle (Johnson & Johnson, 1999a).

The final objective was to promote egalitarian principles. Each group member was required to participate and given an individual task to reach the unified goal. For example, each group had a student who described the solution to the problem and one who recorded the solution. In groups of three students, one student was assigned to summarize the process and record the information. After each question, the students alternated roles. In this way, each member had an opportunity to lead and communicate through verbal and written language.

Action Research Method/Design

This study employed an action research design involving the implementation of CL instruction to assess students' perceptions that lead them to gain an understanding of mathematics so that they become successful in algebra. A qualitative approach was used to collect and analyze data. Qualitative data collected include semi-structured student interviews, field notes of student observations in a participant-researcher's journal, learning artifacts, surveys, and a focus group interview (see Appendix B). Mills (2011) asserts that journals are a continual process for teachers "to systematically reflect on their practice by constructing a narrative that honors the unique and powerful voice of the teachers' language" (p. 86).

An IMRP was developed by the participant-researcher to enable her struggling student-participants to learn algebra in a cooperative setting. In addition to mathematics concepts, the program included instruction developing the following: (1) positive interdependence; (2) accountability; (3) interpersonal skills; (4) promotive interaction; (5) group processing (Johnson & Johnson, 1999a); and (6) egalitarian principles (Kagan, 2014). The IMRP was developed for the Intermediate Algebra classroom and followed the principles of action research for a period of 8 weeks. Students were placed in small heterogeneous groups of two to three members. Each group received CL activities as they worked toward a common goal. Every group member added value and participated in activities through a given task.

Through CL groups, students were able to discuss concepts with a peer at a level similar to their own level of development and understanding. Mertler (2014) asserts that continual reflection for improvement is necessary for each step in the process. After each day of CL, the teacher determined what changes should be implemented and reflected upon improvements for each activity in a participant-researcher's journal. Careful thought was given to determine if all team members worked cooperatively and participated. The teacher-researcher provided positive reinforcement and praise even if the student-participant was not successful. This established clear guidelines for a CL structure and for the study to become cyclical and improvements to be made in subsequent cycles.

This study implemented qualitative action research with progressive pedagogy in order to provide more in-depth understanding of students' perceptions of the IMRP. The participant-researcher was interested in how to manipulate instructional methods to improve student learning. Four semi-structured interviews were conducted with the same two male and two female students at three points in time. Learning artifacts were used with student-participants to reflect and improve the learning process. Reflection notes were kept in a participant-researcher's journal.

CL strategies may positively impact students' perceptions so that they may build a foundation of knowledge in order to become successful in algebra. Through positive interaction with others, students are engaged in activities during every CL lesson. Slavin (2014) asserts that CL can transform a classroom "from remedial to advanced" (p. 26). Research has shown that students from all levels and varying abilities may benefit from CL strategies (Slavin, 1999). This is specifically important to this study because the focus is to improve student learning of algebraic concepts. CL groups were chosen to promote metacognition and strengthen mathematics skills. The activities created by the participant-researcher allowed students to become actively engaged and provided opportunities for every student to be successful.

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a PLC at CHS to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance. The reason to use collaborative groups was to allow students to learn in cohesive units so that they became stronger and performed higher individually. The study explored the relationship between CL groups and increased student understanding. CL has been shown to have a positive impact across gender, SES, at-risk conditions, learning difficulties, and even behavioral issues. Every student may achieve success through CL instruction when it is implemented properly through a variety of engaging activities.

The fundamental question of this study was: "What are ninth-grade and tenth-grade remedial math students' perceptions of an Interactive Mathematics Review Program?" In order to answer the research question to improve student learning, the researcher must understand the variables involved in the study. These variables include gender of participants, age, level of performance, selection bias, proper sample size, time management, school size, attendance, student attitudes, and behavioral issues. According to the United States Department of Education's Mathematics Advisory Panel, "Of particular importance is determining the variables that impede or facilitate transfer. Studies of transfer suggest that people's ability to make links between related domains is limited; studies on how to foster transfer in key mathematical domains are needed" (Faulkner et al., 2008, p. 30).

Plan for Data Collection

Qualitative data collected include semi-structured student interviews, field notes of student observations in a participant-researcher's journal, reflections, surveys, a focus group interview of ninth- and tenth-grade students' perceptions, and learning artifacts such as classwork and homework (see Appendix B). Mills (2011) asserts that journals are a continual process for teachers "to systematically reflect on their practice by constructing a narrative that honors the unique and powerful voice of the teachers' language" (p. 86). This study implements qualitative action research, which provides a comprehensive understanding of the research problem in order to completely answer the research question. Kemmis and McTaggert (1987) convey that teachers and participants involved in action research continually reflect for improvement over the social educational activities in which they are being studied. This research provides greater understanding and improvement of educational practices.

Student-Participant Learning Artifacts

Learning artifacts were used to improve reflective practice from the 25 CL activities conducted in the classroom as well as assigned homework. The participant-researcher was able to assess student needs based upon inaccuracies or misconceptions as compared to the SCCCR (2015) standards assigned during these formative assessments. From each concept missed after collecting learning artifacts, the participant-researcher established goals for student-participants and included these in the Action Plan.

Participants

The action research study was implemented during the spring semester of 2017 with a convenience sample of 21 students enrolled in two Intermediate Algebra classes. The participant-researcher is the teacher of these student-participants. CHS (2016) data showed that 48% of the students enrolled in the participant-researcher's two Intermediate Algebra course received free or reduced lunch. The participant-researcher is not allowed access to specific names of students enrolled in the program. In the sample, 14 of the 21 student-participants have failed at least one previous math course, so most of these students have negative perceptions for learning mathematics. These ninth- and tenth-grade students are typically 15 to 16 years of age, however, two are 17 and three are over 18 years of age. Students are of similar abilities because they are in the same level mathematics course. Every student provided consent and a desire to be placed into the study. In middle block Intermediate Algebra, there were 4 male and 4 female students of which 5 are Black, 1 is Hispanic, 1 is American Indian, and 1 is White. In fourth block, there were 4 males and 10 female students of which 9 are White, 3 are Black, and 1 is Hispanic. Only 7 of the 21 students have been successful in all previous math courses. One student-participant completed the previous course through credit recovery. In the two classes, 9 of the 21 students have a learning disability or receive special accommodation for learning mathematics. Three have additional physical impairments. One student-participant is an English-language learner. All student-participants accepted the invitation to participate in the study, returned parent consent forms, signed assent forms, and offered reflection in order to refine and improve the IMRP (see Appendices E and F). A strategic plan is in place as developed by the participant-researcher to avoid any ethical concerns and set high expectations of ethical standards. Ethical concerns are addressed further later in this chapter.

The Setting

CHS is situated in a large southern, low-SES environment of the district and the student population is 1,936 students (Annie E. Casey Foundation Kids Count data, 2015). Additional information retrieved from Annie E. Casey Kids Count Data (2015) shows that the school is composed of 70% White, 21.4% Black, 6.3% Hispanic, 1% American Indian, and 1.3% Asian/Hawaiian/Pacific Islander. According to High Schools (2015) data, 40.3% of students enrolled in CHS receive free or reduced lunch (para. 9). These data indicate that the high school may become eligible for Title 1 funding.

Building Trust

The researcher built trust with student-participants by first outlining the action research design for all participants and their parents. Communication with parents and students involved in the research is vital to the success of action research. Kerstetter (2012) conveys, “The issue of trust emerges as critical to creating and sustaining successful partnerships” (p. 99). The researcher built a rapport with each student because each is a member of her Intermediate Algebra class. Additionally, students built trust with their group members as they became positively interdependent on each other and interacted with the participant-researcher throughout the learning process. It was important for all students to become actively engaged through the activities presented. Every member of a team had value for the group and an assignment for each activity. Every student received positive feedback from the researcher and from the other group members through successes and through mistakes. The researcher worked to create the most optimal environment where students could learn and grow as individuals. As students gained confidence in building interpersonal skills through CL groups, trust was also built.

Positionality

Dewey (1916) described that CL assisted students to make meaning of learning and allowed them to make deep cognitive connections through an experience. The participant-researcher believes the ideas of Dewey (1916) have created CL opportunities where student-participants learn by completing progressive pedagogical activities and reflections that follow. The participant-researcher is interested in student perceptions and feelings toward CL instruction to improve student learning. The researcher explained the importance of providing student responses, which was to improve the IMRP, and a participation grade was given for 100% completion. Data were collected through coded surveys where the researcher gave every student the same type of pencil and left the room. During student interviews, the participant-researcher was cognizant of her facial expressions so as not to elicit additional responses and she nodded her head in acceptance of any answer whether correct or incorrect. The acceptance gesture would promote extended responses to the open-ended questions presented.

Insider/Outsider Status

The participant-researcher is an insider-researcher for the following reasons in that she: (a) guided students through instructional activities with expertise in algebraic content and knowledge where student-participants struggle through content presented; (b) captured in-depth details of students' perceptions of the IMRP; (c) reflected with student-participants to improve student learning; (d) discussed emerging themes with student-participants; and (e) grew up in a low-income, low-SES community with a great understanding of the issues these students face each day. Merton (1972) asserts that the only through authentic knowledge may the participant-researcher truly understand the culture of the environment through the unique perspective of experience. Additionally, insider-researchers may be able to collect more in-depth data sets through a unique knowledge of shared experiences with student participants according to Dwyer and Buckle (2009).

Merton (1972) asserts:

> There is a special category of people in the system of social stratification who have distinctive, if not exclusive, perceptions and understanding in their capacities as *both* insiders and outsiders…. [They are insiders as outsiders] who have been systematically frustrated by the social system. (p. 29)

The participant-researcher as an outsider is an objective observer who knows the benefits of increasing passing rates for this course and of altering the course of the lives of these lower-level students. Reardon (2011) of the Center for Education Policy Analysis at Stanford notes, "The achievement gap between children from high- and low-income families is roughly 30 to 40 percent larger among children born in 2001 than among those twenty-five years earlier" (p. 91).

As an outsider-researcher, the participant-researcher: (a) developed the IMRP; (b) created CL instructional activities aligned with state standards; (c) analyzed data to discover emerging themes; (d) reflected through memoing in field notes; (e) collaborated with members of the Intermediate Algebra professional learning community to build a team of support for cycle two; and (f) shared findings with administration. This research study is designed to increase passing rates and close the achievement gap among these algebra student-participants at CHS.

Ethical Considerations

A strategic plan is in place as developed by the participant-researcher to avoid any ethical concerns and set high expectations of ethical standards. Prior to conducting the study, the participant-researcher submitted a proposal to the Institutional Review Board (IRB) in order to protect the rights of student-participants. The following ethical concerns were addressed: (1) the nature of the research study; (2) the purpose of the research study; (3) the protection of student-participant identities; and (4) the protection and storage of collected data. First, the nature of the study in terms of its design was described in detail to convey how the students would be served in the classroom. The SCCCR standards were met through each CL instructional activity and reflected the pacing presented by Highland School District. Second, the anonymity of student-participants was maintained through a coding process and encryption of data. Third, data were collected utilizing a coding process on learning artifacts. Fourth, all collected data were stored in a locked cabinet. After all ethical concerns of student-participants were addressed, the IRB approved the research. Highland School District (pseudonym) approved the research when similar conditions were addressed and the district requested a copy of the completed dissertation. Additionally, the participant-researcher invited students to participate in the research study both verbally and in written consent/assent forms. The study was discussed in detail on the first day of the class with both Intermediate Algebra classes. Parent letters and student assent forms were required to be signed in order to participate in the study (see Appendices E and F).

Ethical considerations go beyond district policy because the program begins with character education prior to the first activity. Character education was brainstorming ideas with student-participants to describe ethical values, respect for others, and a social justice component for participation in the study. The teacher and students discussed ideas to create shared values, expectations of conduct, and standard practices for positive interdependence. Students understood they must treat the teacher and each other with respect and maintain a positive attitude. Character education allows students to think about their actions before they occur and establishes core virtues for life skills.

Data Collection Strategies

Qualitative data collection strategies were implemented. The participant-researcher developed an IMRP to enable her struggling students to learn algebra in a cooperative setting in order to improve student learning. The constant comparative method (CCM) was used to describe, conceptually code, and categorically organize the collected data in order to generate the emerging themes (Glaser & Strauss, 1967; Mertler, 2014). This action research study benefited from CCM as separated from grounded theory (Fram, 2013) because the participant-researcher intended to improve the pedagogical practices only within her own classroom, high school, and district. Mertler (2014) asserts, "Action research allows teachers to study their own classrooms…in order to better understand them and to be able to improve their quality or effectiveness" (p. 4). This research study does not seek to explain real-world theories, an element of grounded theory.

The participant-researcher observed students in the cooperative setting while students were actively engaged through progressive pedagogy. She recorded field notes while observing student-participants during each CL activity. At three points in time, four semi-structured interviews described the perceptions of students in the classroom and assisted the researcher to answer the fundamental question of the study: "What are ninth-grade and tenth-grade remedial math students' perceptions of an Interactive Mathematics Review Program?" Two male and two female students were chosen to complete the interviews and they remained the same throughout the completion of the study. In this way, the students' learning outcomes were norm-referenced as well as analyzed for growth across time. The student-participants and the participant-researcher completed reflection activities after each CL activity to improve the pedagogical practices of the classroom and improve student learning.

Data Analysis Strategies

Qualitative data analysis is continual, fluid, and cyclical (Mertler, 2014; Miles & Huberman, 1994). The semi-structured interviews, field notes, observations, reflection surveys, and focus group data were transcribed throughout the 8-week study (see Appendices B and C). Transcription was applied on the day each occurred and included reflection from the participant-researcher. Reflection notes in the form of memos were added as students' perceptions were articulated. Core themes began to emerge as the process of reading was repeated.

Coding Scheme

A coding scheme with colored highlighting was used to group similar pieces of information together (Parsons & Brown, 2002; Mertler, 2014). Patterns were identified as occurrences were repeated throughout the data analysis process. The data were reduced through a process of constant recoding as a means of identifying emerging themes (Glaser & Strauss, 1967). Then a process of open coding, analyzing the data line by line in great detail, was used to determine core categories in the data collection (Strauss, 1987; Creswell, 2007). Axial coding was used to "analyze the data minutely" (Strauss, 1987, p. 31) while selective coding was used to identify the core categories (Strauss, 1987, p. 69). Axial coding allowed the participant-researcher to disaggregate the data by race and gender then polyangulate the data through the coding process to show a relationship between categories. Memoing was used throughout the process of collecting and analyzing data to record occurrences and note reflective ideas (Creswell, 2007). Member checking was initiated with student-participants to improve the quality of the collected data (Mertler, 2014). After each level of analysis, the data were organized into patterns to identify emerging themes, which conveyed the assertions that follow (see Figure 4.1). After the data collection was completed and analyzed according to the above process, the data were coded using MAXQDA Analytics Pro 12 qualitative data analysis software (see Figure 4.1).

Student semi-structured interviews were conducted at three points in time. Student comments were recorded as field notes. After each CL activity, the participant-researcher collected student-created learning artifacts from classwork, and homework. The participant-researcher recorded reflection notes after each CL lesson in the journal. At onset, the participant-researcher highlighted data to look for individual categories and identify general patterns in order to make comparisons. The researcher followed the process outlined by Mertler (2014) for describing data in a narrative form, and data were compared to discover emerging themes among student-participants' perceptions. The core themes revealed the impact of the progressive pedagogy for improving student learning.

Plan for Reflecting with Student-Participants

Costa and Kallick (2009) assert, "Teachers who promote reflective classrooms ensure that students are fully engaged in the process of making meaning. They organize instruction so that students are the producers, not just the consumers, of knowledge" (p. 222). Prior to the first CL lesson, the participant-researcher explained that in Fall

2017, CHS would begin introducing CL activities through professional development and the principal was interested in the participant-researcher's study. This was a great opportunity for their voices to be heard and their help was needed to design future instruction. The participant-researcher was interested in gaining insight into the perceptions and feelings of student-participants who were included in CL instruction.

Semi-structured interviews and surveys were given at three points in time to elicit specific as well as open-ended responses from student-participants (see Appendix C). The answers to surveys allowed improvements to be made for future pedagogical practices as well as subsequent school-year cycles. The participant-researcher analyzed the results and provided general statements from student responses that reflected on CL activities. In this way, no student was embarrassed by the participant-researcher reading his or her answer aloud. The participant-researcher recorded notes in a participant-researcher's journal and included memos. A focus group interview was conducted at the completion of the study.

In order to deal with discrepant cases the participant researcher coded the surveys so that she would know the student who completed the survey without their knowledge. Through a numbering system, the participant researcher was able to ensure all surveys were returned and remove individual responses with utmost accuracy as students moved away from the school or left the program. The explanation follows. Prior to administering the survey, the teacher-researcher explained that there were no right or wrong answers and that the teacher-researcher sincerely cared about their opinions of the IMRP. The teacher-researcher provided each student with the same type of pencil and left the room while the surveys/reflection questionnaires were completed. Each survey/questionnaire was coded so that the teacher-researcher would know which student completed the survey. The teacher handed each out in an S-pattern, which is the same as required for standardized testing. Identifying codes allowed the participant-researcher to analyze the data from each individual student and ask additional questions at a later time to provide greater insight into student perceptions in order to refine the IMRP. Students stated mostly positive learning experiences after the CL activities.

The participant-researcher served to guide student-participants in CL instruction and was able to assist students to construct meaning through the learning process. The students were able to apply the meaning to the next lesson because the concepts of mathematics are cumulative. Through reflection, the participant-researcher was able to guide student-participants through a cyclical process of learning and engagement.

Plan for Designing an Action Plan

The findings of this study reflect students' perceptions through participation in CL instruction. Small academically and culturally heterogeneous groups increased student motivation through peer-to-peer instruction. The participant-researcher also reflected with members of the professional learning community who teach Intermediate Algebra. The researcher was able to share the benefits of CL instruction and together they collaboratively planned to teach Intermediate Algebra classes through CL to improve the IMRP. The participant-researcher's vision for the IMRP is to build a leadership team of PLC members and expand it for all remedial students at CHS.

Through the nine-step action plan, the six objectives of the IMRP are met for every ninth- and tenth-grade remedial mathematics student at CHS. Awareness of these objectives allowed students to use the CL strategies to master the South Carolina

College- and Career-Ready standards (2015) within lessons. Students have access to a community of learners where they become interdependent with other members of the group. Every student is accountable for understanding concepts and has a responsibility to other group members. Student-participants learn important social skills necessary to become a member of the workforce and live in society. As active learners, students gain a greater understanding of concepts and are able to reflect on their experiences. Egalitarian principles are established because every member has value and a role in the CL strategy presented.

The benefits of including an IMRP for all ninth- and tenth-grade remedial students are to prepare them to be successful in future mathematics courses through a strong foundation of knowledge. Dana and Yendol-Hoppey (2014) describe one researcher who assessed the needs of her students during data collection. She then set goals for her students that were related to the research question. To mirror this approach, the participant-researcher reviewed previous as well as current literature and identified specific ideas that equated to the needs of her student-participants. The process required continuous data collection as well as analysis for improvements. After this, the participant-researcher created a schedule and timeline for the events to take place. This makes perfect sense to continue the loop for future cycles while remaining narrowly focused on the research question in order to improve student learning.

Historical Account for Diversity and Inclusion in Secondary Mathematics

Teachers within South Carolina face other challenges of alleviating inequality of student opportunity and even oppression. According to Schramm-Pate, Lussier, and Jeffries (2008):

> The South has been made to represent the origins of racism in America, from which is supposedly spread like an infection to the North…. Resentment of the northern 'other' and of hegemonic representations of southern culture and identity gets played out through Confederate symbols. (p. 149)

The high school where the study took place is situated in a southern, low-SES area of the district. Many students, boys and girls, drive old pickup trucks to school. Some display the Confederate flag; often without realizing the pain it may cause other students. To some cultures, this is a symbol of hate and discrimination that the younger generation may or may not realize. In order to create equal environments conducive to learning, teachers work diligently with student groups where every student may find their place. This work provides opportunities so that every student may become an equally important, valuable member of the system. The high school has an active gay, lesbian, bisexual, and transgender (GLBT) community, Women Ambassadors association, and many multicultural groups to support diversity within the system. These small communities of support within the education system provide social justice and empower the communities that may have been victims of oppression.

Schramm-Pate, Lussier, and Jeffries (2008) assert, "The purpose of civil rights pedagogy is to enable students to be concerned citizens and to enable them to combine theoretical and activist forces to work toward economic, social, political, and environmental justice" (p. 2). There are many goals associated with the progressive pedagogical practices of teaching secondary mathematics that extend beyond critical thinking skills and passing rates. One of those goals is to create the most optimal environment where students may learn and grow as individuals. Every student has a value within the classroom and should be allowed to shine in individual ways. Each student should feel welcome and accepted for exactly who he or she is and the culture in which they live.

Sears (1991) asserts, "For lesbian and gay adolescents, high school is a lonely and often frightening place. Ridicule from teachers, violent harassment from fellow students, and other discriminatory school practices interfere with the ability of gay students to learn" (p. xi). This idea goes beyond GLBT students and reflects every student who has been the victim of oppression. As educators, we have a great responsibility to provide a safe and equal environment, free from discrimination. For every group where there is an imbalance of power, there is great risk involved. Tatum (2013) asserts, "In a situation of unequal power, a subordinate group has to focus on survival" (p. 8). The subordinate members either seek ways to overturn the unequal power or become isolated from the dominant group. In either case, the struggle remains constant. According to Bettez (2008), "Social Justice is about promoting a society with equity among its members" (p. 224). Each of the 25 CL strategies was designed to promote egalitarian principles.

Students are more productive members in the classroom and in their future endeavors if they learn mutual respect for one another. For these reasons and equity among the members of the classroom, this research focused on small group, CL instructional strategies. Each member of the group had responsibility and an equal voice to improve their performance and in-depth understanding of mathematical concepts. Because of the diversity of the dynamics of the group, each member had the potential to gain more than increased knowledge of mathematics. Through CL groups, students became active participants in a face-to-face setting. The members of the group became interdependent. Each member grew through social learning and formed intergroup relationships.

Beyond strengthening mathematical skills to improve student learning, a secondary goal was to form shared commitments to learning with the expansion of new attitudes, opinions, and values.

Hooks (2013) conveys:

> More than any previous movement, for social justice, the struggle to end poverty could easily become the civil rights issue with the broadest appeal – uniting groups that have never before taken a stand together to support the common hope of living in a more democratic and just world – a world where basic necessities of life are available to everyone, to each according to their need. (p. 202)

The high school of the study had a population of approximately 60% White, 30% Black, and 10% other. These percentages were even more proportional among the remedial mathematics courses. Race and gender was a mixed selection for the research. The study was conducted with student-participants from two Intermediate Algebra classes in a southern working-class high school. The teacher-researcher has taught a variety of mathematics courses and has gained a greater understanding of the variables involved in the study that will facilitate or impede transfer of knowledge. If these Intermediate Algebra students have learning disabilities as well, their situations for learning rigorous standards are compounded. Students with disabilities are at an even greater risk of failure and may fall through the cracks without additional support.

According to Wolanin (2013), "Thirty-seven percent of students with disabilities in high school came from families with household incomes below $25,000" (p. 180). In a low-SES community, the number of students with disabilities may be staggering. Within a student population of almost 2,000 children, these students are struggling every day to learn and simply survive. They are in need of support from teachers and instructional activities that promote a positive learning environment. This CL research may positively impact their lives.

Conclusion

This chapter presented a conceptual analysis of qualitative methodology to address ninth- and tenth-grade students' perceptions of an IMRP and was disaggregated by gender and race. A detailed plan for collecting data, reflecting with student participants, and designing an action plan was presented. A conceptual framework guided this researcher to delineate a detailed plan that would fill in gaps of CL literature. Few research studies present a qualitative approach of students' perceptions regarding CL activities for learning mathematics. Research highlighting shortcomings in previous research guided the participant-researcher to assist every student to become successful in this action research study. This qualitative action research addresses the problem of increasing failure rates for remedial students at CHS. In order to answer the research question concerning ninth- and tenth-grade students' perceptions of an IMRP, a strong conceptual framework was established and followed. The purpose of this action research study is to describe ninth- and tenth-grade students perceptions of an IMRP to improve student learning of algebraic concepts by engaging in CL group activities. A secondary purpose is to design an Action Plan in concert with student-participants' perceptions in order to collaborate with other teachers in a professional learning community at CHS to develop CL strategies with their students who struggle with mathematics classes. In order to improve student learning of these remedial level students and completely answer the research question, an IMRP was established.

CHAPTER FOUR: FINDINGS AND IMPLICATIONS

> The research on cooperative learning is like a diamond. The more light is focused on it, the brighter and more multi-faceted it becomes. (Johnson, Johnson, & Smith, 2014, p. 103).

Introduction

The purpose of Chapter Four is to convey the findings and implications of data analyses used to address the research question and improve student learning related to students' perceptions of cooperative learning (CL) instruction (Johnson & Johnson, 1999a). The identified problem of practice for the present action research study determined the need for ninth- and tenth-grade student preparation of remedial mathematics courses at a southern working-class high school that has 1,936 students in grades 9 through 12 (Annie E. Casey Foundation Kids Count data, 2015).

In order to address the problem of practice, the participant-researcher implemented an Interactive Mathematics Review Program (IMRP) in the spring of 2017 for her 21 Intermediate Algebra students. These students have rarely seen success in math courses, and the IMRP sought to alter students' perceptions of learning math concepts in a positive manner. The human experiences captured in this research study are focused upon student-participants' perceptions of CL instruction to improve student learning. Responses, notes, and reflections from qualitative data collection were organized and thematically analyzed throughout the 8-week study (Braun & Clarke, 2006; Mertler, 2014). Qualitative themes were polyangulated with Likert surveys in order to strengthen data analysis and provide in-depth insight into students' perceptions (Mertler, 2014; Mills, 2011). In the following paragraphs, the findings from semi-structured student interviews, formative assessments, field notes (participant-researcher's journal), learning artifacts, and a focus group interview are presented.

Problem of Practice (PoP) Statement

The identified problem of practice for the present action research study involves ninth- and tenth-grade student preparation for remedial mathematics courses at a southern high school of 1,936 students (Annie E. Casey Foundation Kids Count data, 2015). In 2015-2016, the majority of these entry-level students began the year with remedial courses to meet the demands of their credit-bearing mathematics courses. Even then, failure rates among these children were high. According the Cymax High School (CHS) Report Card (2015), 40% of the students enrolled in CHS received free or reduced lunch during the year of study.

The concepts of mathematics (i.e., in this study algebra) are cumulative and a foundation of knowledge from the previous classes is essential to be successful in subsequent classes. Students who have discontinuity of knowledge are not able to perform mathematics concepts at the next level. Using CL strategies to improve student learning of algebraic concepts allows students to build a solid foundation of skills in order to be successful in their current class and higher mathematics classes as well. Over the 2015-2016 school year CHS documented a large increase in failure rates among ninth-grade students in algebra (see Appendix A). Many arrived as ninth-graders with little interest in math, low self-esteem, and few of the necessary skills to be successful

(CHS Mathematics Department, personal communication, October 25, 2016). Therefore, the participant-researcher designed a review program (in the form of an IMRP) for ninth- and tenth-grade students to improve student learning and enable them to meet some of the challenges they face in high school.

Research Question

The research question established the need for greater understanding and intentional investigation of ninth- and tenth-grade students' perceptions of an IMRP to enable these students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research to improve student learning and collect data: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?"

Purpose Statement

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a professional learning community at CHS to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance.

Findings of the Study

The student participants were given 25 CL instructional activities during an 8-week period in the spring of 2017. Through implementation of this progressive pedagogy, the number of activities increased to 25 to accommodate student-participant absences and allow each student to be included in the study. Each student participated in at least 18 CL activities. Semi-structured interviews captured in-depth details about students' perceptions and feelings at three points in time. Student self-evaluation and reflection surveys as well as Likert surveys provided additional information of students' perceptions in order to polyangulate the data. It is important for polyangulation to occur because it allows the participant-researcher to improve accuracy of data through cross-referencing (Mertler, 2014; Mills, 2011).

All study participants continually reflected for improvements. Reflection was first accomplished by collecting self-evaluation and reflection surveys at beginning, middle, and end of the 8-week study. Second, student-participants applied metacognitive reflection and shared ideas for improvements to be made and for each activity to be successful. Third, the participant-researcher reflected throughout each activity in field notes through memoing. Finally, a focus group interview was conducted after all CL activities were completed. The participant-researcher disaggregated the data by gender and race. A code list was generated and the characteristics of the phenomena displayed five core themes: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) CL promotes egalitarian principles; and (5) CL encourages high-quality reciprocity. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students became social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). Students "no longer only concentrated on their own learning but instead shared their mathematics understanding with their team members as well as their other classroom peers" (2016, p. 119). Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), "Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101).

Participants

The action research study was implemented during the spring semester of 2017 with 21 students enrolled in two Intermediate Algebra classes. CHS (2016) data showed that 48% of the students enrolled in the participant-researcher's two Intermediate Algebra course received free or reduced lunch. The participant-researcher is not allowed access to specific names of students enrolled in the program. In the sample, 14 of the 21 student-participants have failed at least one previous math course, so most of these students have negative perceptions for learning mathematics. These students are typically 15 to 16 years of age, however, two are 17 and three are over 18 years of age. Students are of similar abilities because they are in the same level mathematics course. Every student provided consent and a desire to be placed into the study. In middle block Intermediate Algebra, there were 4 male and 4 female students of which 5 are Black, 1 is Hispanic, 1 is American Indian, and 1 is White. In fourth block, there were 4 males and 10 female students of which 9 are White, 3 are Black, and 1 is Hispanic. Only 7 of the 21 students have been successful in all previous math courses. One student-participant completed the previous course through credit recovery. Within the two classes, 9 of the 21 students have a learning disability or receive special accommodation for learning mathematics. Three have additional physical impairments. One student-participant is an English-language learner.

Data Collection Analysis and Coding

The constant comparative method (CCM) was used to describe, conceptually code, and categorically organize the collected data in order to generate the emerging themes (Glaser & Strauss, 1967; Mertler, 2014). This action research study benefited from CCM as separated from grounded theory (Fram, 2013) because the participant-researcher intended to improve the pedagogical practices only within her own classroom, high school, and district. Mertler (2014) asserts, "Action research allows teachers to study their own classrooms…in order to better understand them and to be able to improve their quality or effectiveness" (p. 4). This research study does not seek to explain real-world theories, an element of grounded theory. According to O'Connor, Netting, and Thomas (2008):

> It must be clear that constant comparison, the data analysis method, does not in and of itself constitute a grounded theory design. Nor does the process of constant comparison ensure the grounding of data whether 'grounding' is used in a positivistic or interpretive sense. Simply put, constant comparison assures that all data are systematically compared to all other data in the data set. This assures that all data produced are analyzed rather than potentially disregarded on thematic grounds. (p. 41)

This action research study supported O'Connor et al.'s (2008) assertion of the CCM of analysis. Further investigation into the conceptual framework revealed the need to separate qualitative data analysis (QDA) and grounded theory (GT) in order to avoid what Glaser and Horton (2004) describe:

> The mixing of QDA and GT has the effect of downgrading and eroding the GT goal of conceptual theory. The result is a default remodeling of classic GT into just another QDA method with all of its descriptive baggage. (p. 2)

Glaser and Horton's (2004) argument supports separation of the CCM of analysis from GT and provides a strengthened method of analysis for this action research study. The educational focus of this study maintains emic perspectives (the viewpoints and perceptions of student-participants as insiders). Additionally, the participant-researcher integrates emic and etic perspectives as the participant-researcher in order to improve understanding and apply continual reflection throughout the research. As an insider, she created CL instructional activities based on SCCCR (2015) standards, identified CL groups, assisted groups through instruction using inquiry, and established positive interdependence, egalitarian principles, and accountability between group members. Through observations, interviews, evaluations, and reflections (Mertler, 2014), the participant-researcher was an insider and an outsider in this action research study (Schramm-Pate, 2016).

Qualitative data collection served as the primary data source in the form of field notes from observations, semi-structured interviews, questionnaires, student reflection surveys, student artifacts, and a focus group interview (see Appendices B and C). Since polyangulation is critical to answer the research question completely in order to improve student learning, quantitative data from Likert surveys were collected as a secondary source. Yin (2009) argues that data are more persuasive and precise if they are polyangulated from “several different sources of information” (p. 116).

Qualitative Data Collection

Data were collected during an 8-week period in the spring of the 2016-2017 school year with 21 student-participants. The IMRP was implemented to improve student-learning experiences and capture in-depth details about students’ perceptions in order to answer the research question completely and improve student learning. Qualitative data collection served as the primary data source in the form of field notes from observations, semi-structured interviews, student’s self-evaluation and reflection surveys, student artifacts, and a focus group interview. Qualitative data provides insight into prevailing tendencies of student-participants’ values, beliefs, and experiences (e.g., factors that influence and improve learning algebra) included in this action research study.

Semi-Structured Interviews. Semi-structured interviews captured in-depth details about students’ perceptions and feelings at three points in time: after the first CL activity, at the midpoint of the research, and after the final CL activity (see Appendix B). Semi-structured interviews were conducted with two male (students 4A and 7A) and two female student-participants (students 3A and 14B) during their independent learning time (see Appendix B). The chosen students were one male and one female student with a higher level of ability based on previous standardized test scores as well as one male and one female student where previous test scores indicated remedial ability. These were the same students the participant-researcher previously interviewed so that she could make comparisons across time and measure changes in students' perceptions. The participant-researcher did not audiotape the interviews based upon extreme discomfort from two interviewees and the potential to stifle openness of responses. All four students-participants were comfortable with their answers being recorded as written notes. Because the interviews were conducted during ILT, the participant-researcher reviewed the field notes and added additional thoughts about each conversation. The participant-researcher was actively engaged in the process of interviewing each student-participant and encouraged students to describe their perceptions about the CL activities, previous feelings about mathematics, and how they felt they about their performances in the classroom. In conducting these interviews, the participant-researcher was able to ask the questions outlined for the interviews and follow up on any additional information to capture in-depth details about students' perceptions of the IMRP (Mertler, 2014). Questions were open-ended to allow the student-participant to guide the process, reflect, and improve student learning. Additional student-participants were also questioned at points during engagement of CL activities.

Surveys. Student self-evaluation and reflection surveys as well as Likert surveys provided additional information of students' perceptions in order to polyangulate the data. It is important for polyangulation to occur because it allows the participant-researcher to improve accuracy of data through cross-referencing (Mertler, 2014; Mills, 2011). Prior to the survey, the teacher-researcher explained that there were no right or wrong answers and that the teacher-researcher sincerely cared about their opinions of the IMRP. The teacher-researcher provided each student with the same type of pencil and left the room while the surveys/questionnaires were completed. Each survey or questionnaire was coded so that the teacher-researcher would know which student completed the survey. The teacher-researcher handed each out in an S-pattern, which is the same as required for standardized testing. Identifying codes allowed the participant-researcher to analyze the data from each individual student and ask additional questions at a later time to provide greater insight into student perceptions in order to refine the IMRP. Students stated mostly positive learning experiences after the CL activities.

Reflection. All study participants, including the participant-researcher, continually reflected for improvements. Reflection was first accomplished by having each student group reflect on each of the 25 CL activities for a total of 233 completed assignments considering student attendance (see Appendix D). As a participant, the researcher was able to intervene and guide students to improve reflective practice. To further reflect, self-evaluation and reflection surveys were presented at beginning, middle, and end of the 8-week study. Student-participants applied metacognitive reflection and shared ideas for improvements to be made after each activity in order to be successful. Additionally, the participant-researcher reflected throughout each activity in field notes through memoing.

Focus Group Interview. Finally, a focus group interview was conducted after all CL activities were completed. The participant-researcher provided each student an opportunity to reflect on the process of his or her own learning through open-ended questioning techniques that allowed each student-participant to have the opportunity to refine the IMRP. Even though core themes were discussed with student-participants as they emerged, the participant-researcher discussed themes again to improve reciprocity of the program and continually improve student learning. The focus group interview was designed to elicit student-participants' perceptions through reflective practice that may not be captured through other methods of inquiry.

Ongoing Analysis and Reflection

The participant-researcher completed 14 CL strategies with students in the fall of 2016 with 25 student-participants prior to this research being conducted. The data were never used except to practice. The collection was never analyzed. Since students are accustomed to instant gratification through many previous courses that included direct instruction, the first three activities were chaotic. The participant-researcher was expecting this to occur again and it did. Students were raising their hands and asking questions rather than attempting to complete the activities interdependently with their group members. As before, after the third lesson, the classroom began to manage itself. It was quite a transformation where students were engaged in conversations with each other. An evaluation from an administrator during this time revealed extremely high remarks for cooperation and supporting student learning. He remarked on the level of support the student-participants received rather than direct assistance to complete activities.

There were no other expectations of student learning and no difficulties encountered other than time constraints to complete the research. Since the surveys were coded in a way that the participant-researcher would know which student-participant completed them, there were no discrepancies in removal of data when students left the IMRP or moved away from school.

Reflective Stance

Attendance became an issue with several students and there were 45 total absences (see Appendix D). Student-participants brought in many medical excuses but the IMRP needed data to fill these gaps in instruction. This easiest solution for this situation was to include more CL instructional activities to see improvement in student learning and include as many students as possible in the IMRP data collection and analysis. Each learner completed at least 18 CL instructional activities during the 8-week study.

A second challenge was that a student was extremely uneasy about working in groups and stated she would not work with anyone. So, on the first CL activity student-participants were placed in a semi-circle where all were equal. It was highly effective at placing the students at ease. The participant-researcher discovered she was over 18 years old in the ninth grade. She became peer leader and worked well in groups. Her conceptual understanding highly improved and her grades improved from C's to A's.

A third challenge was teaching remedial students to reflect in order to improve student learning. These students have rarely seen success in math courses and many have negative perceptions of learning math. Student-participants were making comments like, "I am stupid" and "I am not good at math." During the first few lessons, students were uneasy about working in groups and were just learning to become interdependent on their team members. Many were passive and not as vocal at that time. In addition, each of the activities presented was designed through directions for students to describe the process of finding solutions to problems. For many students, it was the first real effort they had put forth to learn math. Instead of helping each other learn, student-participants were raising their hands to ask the participant-researcher questions. They were quite frustrated when they were not instantly gratified with answers. Not only were they struggling to learn the new math concepts, they were struggling to describe how to correct their mistakes. The participant-researcher used inquiry techniques to help student-participants solve their own problems and become team members. Group processing and reflection were requirements for each of the 25 lessons either through discussing their mistakes and improvements, using their learning artifacts to increase understanding, or completing student perceptions and reflection surveys. As students grew more confident and found success, their reflections improved. The IMRP sought to positively alter students' perceptions of learning math concepts. A goal of the next cycle is to train students to make deeper connections to why their mistakes occurred. The leadership team will ask student-participants to model reflections to train team members to apply cognitive thought for what could be improved in each lesson. PLC leadership team members will use inquiry of learning mathematical concepts and open-ended questioning techniques to further reflective practice in concert with student-participants' perceptions of the IMRP model. Step four of the action plan in Chapter Five addresses this challenge to improve student-participants' reflective practice.

A fourth challenge was dealing with a student who decided not to work. Learning is not optional. The student was allowed to work as an individual but chose not to work at all which was not an option. After contacting parents and a one of his teachers, the student decided to complete CL instruction and worked pretty well in group activities.

Qualitative Data Analysis

The semi-structured interviews, field notes, observations, reflection surveys, and focus group data were transcribed throughout the 8-week study (see Appendices B and C). Transcription was applied on the day each occurred. Reflection notes in the form of memos were added as students' perceptions were articulated. Core themes began to emerge as the participant-researcher read and reread the data to identify emerging themes.

Coding Scheme

A coding scheme with colored highlighting was used to group similar pieces of information together (Mertler, 2014; Parsons & Brown, 2002). Patterns were identified as occurrences were repeated throughout the data analysis process. The data were reduced through a process of constant recoding as a means of identifying emerging themes (Glaser & Strauss, 1967). Then a process of open coding, analyzing the data line by line in great detail, was used to determine core categories in the data collection (Creswell, 2007; Strauss, 1987). Axial coding was used to "analyze the data minutely" (Strauss, 1987, p. 31) while selective coding was used to identify the core categories (Strauss, 1987, p. 69). Axial coding allowed me to disaggregate the data by race and gender then polyangulate the data through the coding process to show a relationship between categories. Memoing was used throughout the process of collecting and analyzing data to record occurrences and note reflective ideas (Creswell, 2007). Member checking was initiated with student-participants to improve the quality of the collected data (Mertler, 2014). After each level of analysis, the data were organized into patterns to identify emerging themes, which conveyed the assertions that follow (see Figure 4.1).

Charmaz (2014) argues, “Build your analysis step-by-step from the ground up without taking off on theoretical flights of fancy. Having a credible amount of data that speaks to your research topic further strengthens the foundation” (p. 125) of the study. After the data collection was completed and analyzed according to the above process, the data were coded using MAXQDA Analytics Pro 12 qualitative data analysis software (see Table 4.1).

Figure 4.1. *Core Themes and Related Subcodes*

Data Analysis Results

To answer the research question completely, a code list was generated and the characteristics of the phenomena displayed five core themes: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) CL promotes egalitarian principles; and (5) CL encourages high-quality reciprocity. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students became social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), "Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101).

Table 4.1. *Code List*

Code List	
AC	Assignment Completed
ACC	Accountability
AE	Actively Engaged
COM	Communication
EGP	Egalitarian Principles
EO	Equal Opportunities
EP	Equal Participation
EV	Equal Voice
GP	Group Processing
HA	Higher Achievement
ID	Interdependence
MC	Metacognition
MD	Math Discussion
MF	Maintains Focus
ML	Motivation to Learn
MT	Math Terminology
NA	Negative Attitude
NI	Negative Interactions
PA	Positive Attitude
PD	Promotes Diversity
PI	Positive Interactions
QR	Quality Reciprocity

RE	Reflection
SC	Self Concept
SMC	Self Managing Classroom
SLPT	Student Led Peer Tutoring
SS	Social Skills
TQ	Teacher Questioning/Assistance
UND	Understanding/Comprehension
WML	Written Math Language
WT	Working Together

The first core theme, CL instruction promotes increased comprehension, emerged beginning in the first lesson and equated to 748 opportunities for this to occur throughout the 8-week cycle of 25 CL activities and responses (see Tables 4.2 and 4.3). There were 342 comments/memos in field notes, 113 collected learning artifacts, 152 reflection examples, 13 statements in semi-structured interviews, and 128 Likert responses. Active engagement in learning was expressed by 233 CL completed activities. Reflections occurred 246 times through 170 field notes/memos, 63 students' reflection surveys, 12 semi-structured interviews and a focus group interview. Students often used their learning artifacts to improve their understanding of concepts. Metacognition is conveyed through 103 field note examples, 18 learning artifacts (flip book), and 37 Likert survey responses (e.g., "To help other students understand math concepts that I already understand"). Higher achievement was stated 141 times in field notes. Self-concept was stated in 29 examples in field notes.

Table 4.2. *Core Theme One Frequency Chart*

Core Theme and Subthemes	**f**
Core Theme One: *Cooperative learning instruction promotes increased comprehension*	748
Reflection	246
Active Engagement in Learning	233

Metacognition	158
Higher Achievement	141
Self-Concept	29

Table 4.3. *Core Theme One: Cooperative Learning Promotes Increased Comprehension*

Students' Perceptions of Cooperative Learning Groups	
Core Theme One: *Cooperative learning instruction promotes increased comprehension*	
Subthemes	Selected Students' Comments or Notes that Impacted Themes
Metacognition	Black female student with the highest average in both classes, Student 3A "I like CL activities because I understand every lesson. I really have to think about how to teach other students to attack problems. That is difficult." She has been placed in a higher-level math class next year for her high performance and is even considering taking honors courses, which are two levels higher.
Higher Achievement	Black female student with a learning disability, student 2A "My mom did not believe me when I told her my nine weeks grade was a 94!! I have never had an A in math."
Active Engagement in Learning	Memo: All students are working and no students are on their phones. Some students are standing to do their work. Prompt: How did students in your group help each other learn? Student 14B "We worked together as a partner and as a team. We talked it out." (17-year-old tenth grade student)
Learn through an experience	Memo: Each CL activity was designed for students to be actively engaged in learning where they "learned by doing." Experiencing learning produces in-depth understanding that may be retained into subsequent levels of math. Building a foundation of knowledge is important for being successful in future courses.
Reflection	Memo: We reflect about what we have learned at the end of each lesson. We discuss what went right and what could be improved for the next lesson. This may be the most important part of the learning process because students remember to ask questions to fill in gaps in knowledge from the lesson.

Self-concept	Memo: Students were instructed prior to the first lesson to encourage other members when they make mistakes and praise them when they are correct. Character education is vital to creating a safe environment for remedial students who have rarely seen success in math. Supporting each other in learning is fundamental to improving self-concept. Student 4A "I have not always been too good with group work but I like learning like this. I try to have all the basics down to the littlest detail from what I need to know. It does not bother me to ask questions in my group even if they sound stupid because this makes me want to earn the highest grade possible."

Core theme two, CL instruction increases engagement and math-related discussions, appears 419 times (see Tables 4.4 and 4.5). It was evident in 233 completed activities, 58 reflections, and 128 Likert survey responses (e.g., "work well with others, engage in math-related discussions, and more comfortable communicating in a cooperative group"). Enhanced understanding explanation is presented in core theme one. Increased communication was stated 373 times through 233 completed activities, 58 reflections, and 82 Likert survey responses (e.g., "engage in math-related discussions and more comfortable communicating in a cooperative group"). Written math language and math terminology were conveyed in 233 learning artifacts and 55 reflections. Students were able to gain different perspectives in problem solving through diverse groups in 219 CL group activities from field notes.

Table 4.4. *Core Theme Two Frequency Table*

Core Theme and Subthemes	**f**
Core Theme Two: *Cooperative learning instruction increases engagement and math-related discussions*	419
Enhanced Understanding (from Core Theme One)	748
Increased Communication Skills	373
Written Math Language	288

Math Terminology	288
Gain Different Perspectives in Problem Solving	219

Table 4.5. *Core Theme Two: Cooperative Learning Instruction Increases Engagement and Math-Related Discussions*

Students' Perceptions of Cooperative Learning Groups	
Core Theme Two: *Cooperative learning instruction increases engagement and math-related discussions*	
Subthemes	Selected Students' Comments or Notes that Impacted Themes
Enhanced Understanding	Prompt: How did you write the equation of the line perpendicular to the given line? Student 5B "First, change the sign of the slope and flip it. Then, use slope intercept form to plug in the x, y, and slope. Then, distribute the slope and solve for y."
Gain different perspectives in problem solving	Student 4A "I like learning from others ideas. It drives me to make sure I get it right so that I don't miss a step. It burns into my brain."
Increased communication skills	[When we talk in groups], Student 14B "I remember more about the steps to solve the problem and get less distracted when remembering the stuff I need to remember for the test."
Math terminology	Student 7A "It is easier to talk about math with a partner and learn the math words to answer the questions."
Written math language	Memo: CL Flipbook Activity required students to write and explain in great detail 5 prompts to review for the test. One student with a learning disability and physical impairment found it easy. She began tutoring other students on how to explain each step.

Core theme three, CL increases motivation, was conveyed 559 times through 224 field note statements, 14 interview statements, 233 completed activities, and 88 Likert survey responses (e.g., "CL motivates me to learn; more likely to complete math assignments when working in CL groups") (see Tables 4.6 and 4.7). There were 471 successful student-led peer-tutoring responses stated through 172 field notes, 15 interview statements, 233 completed assignments, and 51 Likert responses ("more likely to complete math assignments when working cooperatively"). There were 233 learning artifacts where every member achieved success, maintained focus, and completed assignments. The self-managing classroom, where students were immediately engaged in learning, occurred 43 times. Middle block was able to complete activities more autonomously in a cooperative group on the fourth CL activity and in fourth block on the fifth CL activity.

Table 4.6. Core Theme Three Frequency Table

Core Theme and Subthemes	**f**
Core Theme Three: *Cooperative learning increases motivation*	559
Student Led-Peer Tutoring	471
Every Member Achieves Success	233
Maintains Focus	233
Assignments Completed	233
Self-Managing Classroom	43

Table 4.7. Core Theme Three: Cooperative Learning Increases Motivation

Students' Perceptions of Cooperative Learning Groups
Core Theme Three: *Cooperative learning increases motivation*
"Cooperative learning motivates me to learn because the work is too much to do by myself. This class is really hard."

Subthemes	Selected Students' Comments or Notes that Impacted Themes
Self-Managing Classroom	Today I implemented personalized group learning to review for the test and the end of course exam (EOC). Students had to graph lines interactively on their iPads by manipulating points in order to solve systems of equations. The struggle they encountered made them depend on each other more. No student had their phones out and all were engaged in the learning process. All students are engaged and discussing their activity.
Student-Led Peer Tutoring	Student 13B "We had different ways to find the slope-intercept form and we learned from each other." Student 10B "My people think like I think. Sometimes teachers do not understand the questions I am asking. I like learning like this."
Every Member Achieves Success	Student 5A "I like the Kahoot activities best because they make me work faster to help my group beat the other groups." Reference to Kahoot is an interactive game online that assigns point values for speed and accuracy. Every team has an opportunity to complete each question and be successful.
Maintains Focus	Prompt: How were you able to complete the entire assignment that quickly? Student 15B "It is just easier to focus when I am doing the work in a group. I usually fall asleep in 4th block when I just take notes."
Assignments Completed	Out of a possible 241 CL activity, 233 were completed. The total 241 includes absences but excludes students' behavioral issues, nurse visits, and early dismissals. There were 8 of these occurrences. All students who were in class in its entirety completed their assignments. There were a total of 45 student absences.

Core Theme Four: Egalitarian principles were stated 558 times through 173 field notes, 89 reflections, 16 statements in semi-structured interviews, 233 CL group activities, and 47 Likert responses (e.g., participate equally when working in a cooperative group) (see Tables 4.8 and 4.9). CL fosters social skills occurred in 126 field notes, 89 reflections, 233 completed activities and 47 Likert responses. CL promotes diversity was established in at least 219 CL activities after absences, nurse visits, and in-school suspensions (ISS) were recorded. Equal participation was stated 393 times through 233 learning artifacts, 113 field note statements, and 47 Likert survey responses.

Equal opportunities to learn and equal voices in the learning process were requirements of CL group activities and there were 233.

Table 4.8. *Core Theme Four Frequency Table*

Core Theme and Subthemes	**f**
Core Theme Four: *Cooperative learning promotes egalitarian principles*	558
Fosters Social Skills	495
Equal Participation	280
Equal Voice in the Learning Process	233
Equal Opportunities To Learn	233
Promotes Diversity	219

Table 4.9. *Core Theme Four: Egalitarian Principles*

Students' Perceptions of Cooperative Learning Groups	
Core Theme Four: *Cooperative learning promotes egalitarian principles*	
Subthemes	Selected Students' Comments or Notes that Impacted Themes
Promotes Diversity	Memo: Mutual respect for others feelings and attitudes was a requirement and groups are purposefully chosen to be academically and culturally heterogeneous as often as possible. CL instructions were designed so that every member of the team had input for learning outcomes. Only one student was defiant for a short period of time and was sent out of the classroom (3 of 25 lessons). Learning is not optional. All students must respect each other and the teacher. He later got back on track.
Equal Opportunities to Learn	During the first CL activity, student 2A stated, "I cannot do any work on my own. I always have help from Mrs. T (special education teacher). I take all my tests with her too. I only copy notes in class and nothing else." Memo: I said that she had to complete her assignments with her partner and that it would be fun. She was really upset but completed the activity. After a few activities, she began to like it

	and was earning an A on every test. I spoke with the resource teacher to allow her with permission to at least begin her quizzes with me. She was upset about that too but complied. She now starts all tests in my room and is still earning high As with zero retests. On the last test she only completed two questions with her special education teacher for verbal clarification! We are all so proud of her. She told me, “Mrs. W, you are a good teacher!” I stated, “And you are an excellent student! I am so proud of you!”
Equal Voice in the Learning Process	Memo: Students have an equal voice in discussions and a voice in limited choices for learning. Their favorite activity, an online interactive game, became a regular part of the routine at least once per week.
Equal Participation	Student 8B “I used to hate group work because I was the only one who worked and the other students got the grade I earned. But this way, they have no choice but to do their part.”
Fosters Social Skills	Student 3A with the highest average does not speak to the teacher very often because she does not usually have questions. She understands what to do after the directions and works with her partner. After a couple of activities, she requested to work with a student who was clearly struggling but putting forth every effort to learn. Her tutoring skills were very organized and thoughtful. The two worked well together since she was soft spoken and he was a little more vocal (The struggling student had been in a special education classroom until this year but the researcher was unaware of this until the midpoint of the research).

Core Theme Five: High-quality reciprocity was conveyed 783 times through 194 field notes, 93 reflections, 233 completed activities, and 263 Likert responses (e.g., “work well with others in a cooperative setting, am able to help other students understand math concepts that I already understand, more likely to complete my math assignments when I work cooperatively, more likely to engage in math-related discussions in a cooperative group, attempt to participate equally, and more comfortable communicating what I do not understand in a cooperative group”) (see Tables 4.10 and 4.11). Social skills were stated 495 times in 126 field notes, 89 reflections, 233 completed activities and 47 Likert responses. Work together toward a common goal was established 416 times through 136 field notes, 233 learning activities and 47 Likert surveys (attempt to participate equally). Accountability and positive interdependence occurred 233 times as a requirement for CL activities. Group processing occurred 233 times through 170 field notes/memos and 63 students' reflection surveys.

Table 4.10. Core Theme Five Frequency Table

Core Theme and Subthemes	**f**
Core Theme Five: *Cooperative learning encourages high-quality reciprocity*	783
Social Skills	495
Working Together Toward a Common Goal	416
Accountability for Every Student	233
Positive Interdependence	233
Group Processing	233

Table 4.11. Core Theme Five: High-Quality Reciprocity

Students' Perceptions of Cooperative Learning Groups	
Core Theme Five: High-Quality Reciprocity	
Subthemes	Selected Students' Comments or Notes that Impacted Themes
Positive Interdependence	Prompt: Did your feelings about math improve when the other members praised you? Why? Student 14B "Yes, good job makes me think positive and that I am understanding and getting it right." Student 13B "We had different ways to find slope-intercept form and we learned from each other."
Accountability for Every Student	Memo: Each student was assigned a role for every lesson and participation was a requirement.
Working Together Toward a Common Goal	Memo: Each CL lesson is designed so that every student reached the finish line. Student 7B "I enjoy working with a partner now. I didn't at first

	but it helps to do activities together so I remember all the steps for the test." Student 4A "[CL] is like sports because I keep working until I get it right. When I work with a partner, I remember the steps."
Positive Attitude	Only 1 student had a negative attitude and would not complete the assignments for 3 days intermittently. He walked out two days and was sent to discipline one additional day for nonparticipation. He started to work after these 3 events. Each student completed at least 18 CL lessons during the 8-week study. Two students, who extremely disliked each other, became really good friends during the class.
Group Processing	Student 6B "I was able to ask questions in my group without having to wait on the teacher." Student 5A "I don't like to ask questions in front of the whole class but it is easy to ask questions with a partner. Even if the questions sound stupid, I don't care. I will ask it anyway because I want to learn."

Quantitative Data Analysis

Students were surveyed using 11 prompts of perceptions regarding CL instruction. Each student was asked how much they "agree or disagree" with the following prompts. A comparison of weighted means based on a 5-point Likert scale was used to understand students' perceptions of CL. Each level of agreement or disagreement was given a point value in order to calculate weighted means and to give each response a voice in the research. The point values assigned follow: Strongly Disagree (1), Disagree (2), No Opinion (3), Agree (4), and Strongly Agree (5). Weighted means were calculated individually using TI-84 technology (see Tables 4.12 – 4.17). Standard deviation is included in parentheses to correlate with each weighted mean to provide evidence of normal distribution or lack thereof. According to Norman (2010), parametric tests can be used with ordinal data from Likert scales and may yield better assumptions to identify patterns. He contends that parametric tests have reduced bias in revealing the truth or accuracy of responses even when the normal distribution is extremely violated.

Norman (2010) argues:

> Thus both theory and data coverage on the conclusion that parametric methods examining differences between means, for sample sizes greater than 5, do not require assumptions of normality, and will yield nearly correct answers for manifestly nonnormal and asymmetric distribution like exponentials. (p. 628)

Each statement prompt was aligned to measure the constructs within the six objectives of the study: (1) positive interdependence; (2) accountability; (3) interpersonal skills; (4) promotive interaction; (5) group processing, and (6) egalitarian principles. The following tables (Tables 4.12 – 4.17) reveal that students' perceptions increased over the 8-week time interval in almost all categories. The midpoint of this 5-point scale is 3.0. Therefore, any means exceeding this value indicated agreement and any means that fell below this value indicated disagreement. Of particular importance is the polyangulated finding that students conveyed with highest overall agreement that they were more comfortable communicating math concepts they do not understand in a CL group. The student-participants also indicated higher growth that they understood more in a CL group and were more likely to engage in math-related discussions.

Individual categorical higher growth in agreement for CL instruction results indicate that male students work well with others in a cooperative setting, are more motivated to learn, have increased understanding, and are more likely to engage in math-related discussions when working CL groups. Female students' results indicate they have greater understanding of math content, are more likely to participate equally, are more motivated, and are more likely to complete their math assignments when engaged in CL groups. White students' results suggest that they attempt to participate equally, are more motivated to learn, and understand math more when working in CL groups. Black students' results suggest they feel that activities/questions completed through CL groups strongly enhanced their understanding, and feel comfortable working in CL groups. Hispanic and American Indian results suggest they attempt to participate equally, have greater understanding of math content, and are more likely to engage in math-related discussions in CL groups. Only 6 out of 198 means suggested disagreement. Disagreements were: male students' enjoyment of learning math at the first and middle checkpoints, White students' enjoyment of learning math at the first checkpoint, male students' engagement in math-related discussions at only the first checkpoint, Hispanic and American Indian students' enjoyment of learning math at only the midpoint, and Hispanic and American Indian students' attempts to participate equally when working in a cooperative group at the first checkpoint. At the final checkpoint for individual prompts, overall agreement in categories indicates positive perceptions of CL instruction.

It is important to note that students were not asked to state their race on any survey. Each survey was coded in a way that the participant-researcher could ensure each survey was returned and that she would know which student completed that particular survey when she handed them out individually numbered. Students were not aware that the numbering system allowed me to disaggregate the surveys by race (Schramm-Pate, 2016). One student indicated his gender as attack helicopter and the participant-researcher was able to identify this student and his gender through the coding system. This action also allowed the removal of data from four students who were withdrawn from the study to achieve the highest level of accuracy in results.

Table 4.12. *All Students' Likert Survey Results*

All Students' Likert Survey Results Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL Activity	Midpoint	After Completion of CL Activities
1) I enjoy learning math	3.05 (1.13)	3.10 (.97)	3.48 (.79)
2) I work well with others in a cooperative setting	3.76 (.59)	3.81 (.70)	4.05 (.62)
3) I understand math more when I work in cooperative learning groups	3.57 (.64)	3.52 (.65)	4.24 (.51)
4) I feel comfortable participating in cooperative learning groups to learn math	3.52 (.58)	3.67 (.96)	3.90 (.68)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	3.52 (.73)	4.05 (.65)	4.10 (.53)
6) I am able to help other students understand math concepts that I already understand	3.62 (1.05)	3.86 (1.08)	3.90 (.81)
7) Cooperative learning groups motivate me to learn	4.00 (.82)	3.38 (.84)	4.10 (.53)
8) I am more likely to complete my math assignments when I work cooperatively	3.67 (.78)	3.95 (.65)	4.19 (.39)
9) I am more likely to engage in math-related discussions in a cooperative group	3.33 (.89)	3.52 (.85)	4.00 (.44)
10) I attempt to participate equally when working in a cooperative group	3.38 (.95)	3.67 (.56)	4.19 (.39)
11) I am more comfortable communicating what I do not understand in a cooperative group	3.48 (.91)	3.76 (.61)	4.86 (.71)

Table 4.13. *Male Students' Likert Survey Results*

Male Students' Likert Survey Results Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL activity	Midpoint	After completion of CL Activities
1) I enjoy learning math	2.86 (1.25)	2.86 (1.25)	3.43 (1.05)
2) I work well with others in a cooperative setting	3.71 (.70)	3.57 (.73)	3.86 (.64)
3) I understand math more when I work in cooperative learning groups	3.14 (.73)	3.14 (.83)	4.14 (.64)
4) I feel comfortable participating in cooperative learning groups to learn math	3.43 (.49)	3.43 (1.18)	3.86 (.64)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	3.57 (.73)	3.57 (.49)	4.00 (.49)
6) I am able to help other students understand math concepts that I already understand	3.43 (.73)	3.29 (.70)	3.43 (.49)
7) Cooperative learning groups motivate me to learn	3.14 (.76)	3.14 (.64)	4.28 (.45)
8) I am more likely to complete my math assignments when I work cooperatively	3.86 (.35)	3.71 (.88)	4.14 (.35)
9) I am more likely to engage in math-related discussions in a cooperative group	2.86 (.99)	3.14 (.83)	3.86 (.35)
10) I attempt to participate equally when working in a cooperative group	3.43 (1.05)	3.71 (.45)	4.00 (.00)
11) I am more comfortable communicating what I do not understand in a cooperative group	3.14 (1.12)	3.57 (.73)	3.57 (.73)

Table 4.14. *Female Students' Likert Survey Results*

Female Students' Likert Survey Results Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL activity	Midpoint	After completion of CL Activities
1) I enjoy learning math	3.14 (1.06)	3.21 (.77)	3.50 (.63)
2) I work well with others in a cooperative setting	3.79 (.56)	3.92 (.70)	4.14 (.64)
3) I understand math more when I work in cooperative learning groups	3.29 (.61)	3.71 (.45)	4.29 (.45)
4) I feel comfortable participating in cooperative learning groups to learn math	3.57 (.62)	3.79 (.77)	3.93 (.70)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	3.50 (.73)	3.93 (.59)	4.14 (.64)
6) I am able to help other students understand math concepts that I already understand	3.36 (1.16)	4.14 (1.12)	3.71 (.83)
7) Cooperative learning groups motivate me to learn	3.36 (.72)	3.5 (.91)	4.00 (.53)
8) I am more likely to complete my math assignments when I work cooperatively	3.57 (.90)	4.07 (.46)	4.21 (.41)
9) I am more likely to engage in math-related discussions in a cooperative group	3.57 (.73)	3.64 (.80)	4.07 (.46)
10) I attempt to participate equally when working in a cooperative group	3.36 (.89)	3.64 (.61)	4.29 (.45)
11) I am more comfortable communicating what I do not understand in a cooperative group	3.64 (.72)	3.86 (.52)	4.00 (.65)

Table 4.15. *White Students' Likert Survey Results*

Likert Survey Results Disaggregated by Race – White Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL activity	Midpoint	After completion of CL Activities
1) I enjoy learning math	2.80 (1.08)	3.10 (.83)	3.40 (.49)
2) I work well with others in a cooperative setting	3.60 (.49)	3.70 (.78)	4.00 (.63)
3) I understand math more when I work in cooperative learning groups	3.50 (.50)	3.40 (.49)	4.20 (.40)
4) I feel comfortable participating in cooperative learning groups to learn math	3.50 (.67)	3.70 (.78)	3.80 (.60)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	3.50 (.81)	4.10 (.54)	3.80 (.40)
6) I am able to help other students understand math concepts that I already understand	3.70 (.78)	3.90 (1.14)	4.30 (.78)
7) Cooperative learning groups motivate me to learn	3.10 (.70)	3.50 (.92)	3.90 (.54)
8) I am more likely to complete my math assignments when I work cooperatively	3.50 (.92))	4.00 (.45)	4.10 (.30)
9) I am more likely to engage in math-related discussions in a cooperative group	3.40 (.49)	3.60 (.80)	4.00 (.45)
10) I attempt to participate equally when working in a cooperative group	3.30 (.90)	3.70 (.64)	4.20 (.40)
11) I am more comfortable communicating what I do not understand in a cooperative group	3.50 (.67)	3.80 (.40)	3.70 (.64)

Table 4.16. *Black Students' Likert Survey Results*

Likert Survey Results Disaggregated by Race – Black Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL activity	Midpoint	After completion of CL Activities
1) I enjoy learning math	3.13 (1.27)	3.50 (.87)	3.75 (.97)
2) I work well with others in a cooperative setting	3.88 (.78)	4.00 (.71)	4.25 (.66)
3) I understand math more when I work in cooperative learning groups	3.50 (.86)	3.50 (.71)	4.13 (.71)
4) I feel comfortable participating in cooperative learning groups to learn math	3.50 (.50)	3.50 (1.07)	4.13 (.71)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	3.50 (.71)	3.89 (.78)	4.38 (.48)
6) I am able to help other students understand math concepts that I already understand	3.63 (1.22)	4.13 (1.05)	3.75 (.83)
7) Cooperative learning groups motivate me to learn	3.50 (1.07)	3.25 (.83)	4.25 (.43)
8) I am more likely to complete my math assignments when I work cooperatively	3.75 (.66)	3.75 (.83)	4.25 (.66)
9) I am more likely to engage in math-related discussions in a cooperative group	3.38 (.70)	3.38 (.99)	4.00 (.50)
10) I attempt to participate equally when working in a cooperative group	3.63 (.70)	3.50 (.50)	4.25 (.43)
11) I am more comfortable communicating what I do not understand in a cooperative group	4.00 (.71)	3.63 (.70)	3.89 (.78)

Table 4.17. *Hispanic and American Indian Students' Likert Survey Results*

Likert Survey Results Disaggregated by Race - Hispanic and American Indian Weighted Mean and Standard Deviation (σ)			
Survey Prompt	After 1st CL activity	Midpoint	After completion of CL Activities
1) I enjoy learning math	3.67 (.47)	2.00 (.82)	3.00 (.82)
2) I work well with others in a cooperative setting	3.67 (.47)	3.33 (.47)	3.67 (.47)
3) I understand math more when I work in cooperative learning groups	3.67 (.47)	3.33 (.47)	4.67 (.47)
4) I feel comfortable participating in cooperative learning groups to learn math	3.67 (.47)	4.00 (.82)	4.00 (.82)
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding	4.00 (.00)	3.67 (.47)	4.33 (.47)
6) I am able to help other students understand math concepts that I already understand	4.00 (.82)	3.33 (.47)	3.33 (.47)
7) Cooperative learning groups motivate me to learn	3.33 (.47)	3.33 (.47)	4.00 (.00)
8) I am more likely to complete my math assignments when I work cooperatively	4.00 (.00)	4.00 (.00)	4.00 (.00)
9) I am more likely to engage in math-related discussions in a cooperative group	3.00 (1.41)	3.67 (.47)	4.00 (.00)
10) I attempt to participate equally when working in a cooperative group	2.67 (1.24)	4.00 (.00)	4.00 (.00)
11) I am more comfortable communicating what I do not understand in a cooperative group	4.00 (.94)	4.00 (.82)	4.00 (.82)

Presentation of the Findings

The most difficult part of establishing the IMRP is completing the first three or four days of CL activities. Students desire instant gratification rather than working on their own to complete problems. Rather than following the directions, students decided to "divide and conquer" by equally dividing the work to finish quickly. There was no concern for answering the questions correctly. Their goal was to simply finish. One male student asked on the first activity, "Why don't you just show us how to do these problems like other teachers?" My response was:

> You have learned these concepts many times over the past three years and yet you do not know how to solve these problems. Let's try the activities and see if you are able to understand the concepts rather than just memorize the steps.

In completing activity one, a Hispanic, an American Indian, and many female students did not want to speak at all. Many were reluctant to work in groups. The participant-researcher was concerned that this would continue because the population of students was diverse. Through promotion of progressive pedagogy, the quiet female student asked if she could work with a struggling male student because she knew she could help improve his work. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students become social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). The authors described that the CL curriculum established a student-centered learning environment, which provided an opportunity for students to communicate their understanding of math concepts with their cooperative groups as well as other students in the classroom. Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), “Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students” (p. 101).

Answering the Research Question

The research question established the need for greater understanding and intentional investigation of ninth- and tenth-grade students’ perceptions of an IMRP to enable these students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research, improve student learning and collect data: “What are ninth-grade and tenth-grade remedial mathematics students’ perceptions of an Interactive Mathematics Review Program?”

In answering this question, every student-participant gave the participant-researcher the opportunity to challenge his or her negative perceptions of learning mathematics through implementation of progressive pedagogy. Each student-participant returned a signed parent permission form and signed a student assent form (see Appendices E and F). During the data collection process students completed 233 learning activities, 246 reflections (170 field notes/memos, 63 students’ reflection surveys, 12 semi-structured interviews, and a focus group interview), answered hundreds of questions, responded to 63 Likert surveys, and 4 of these students agreed to be interviewed individually during their independent learning time. Combined, these questions, surveys, and interviews totaled approximately 3,000 responses. To answer the research question completely, a code list was generated and the characteristics of the phenomena displayed five core themes: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) CL promotes egalitarian principles; and (5) CL encourages high-quality reciprocity. These results are similar to previous studies (Sherrod, Dwyer, & Narayan, 2009; Veloo, Md-Ali, & Chairany, 2016; Wu, Anderson, Nguyen-Jahiel, & Miller, 2013) that are indicated below.

Core Theme One: CL Promotes Greater Comprehension

Student responses indicated that CL instruction helped them understand math concepts and they felt prepared for formative and summative assessments. Students indicated that they liked to be actively engaged in activities through this type of progressive pedagogy. CL groups kept them awake, focused, and motivated to learn. They stated they had to really think about how to explain steps to their partners in order to solve problems, which indicated metacognition. Reflecting on their own learning artifacts and questions allowed them to go back and review what they had missed. They stated they had never done that before but it helped them "get it right." Many indicated that their math grade had never been a passing score much less an A or B. One female student with a learning disability had a high A average at the end of the 8 weeks. She had previously told me that she could not complete any work in class and she could only take notes. This quickly changed when the participant-researcher explained that the student-participant would learn more if she would try to complete the activities. She had never taken a test in a regular math classroom with her peers and had always needed teacher assistance to help her through all graded assessments. Now this student takes all tests in my classroom with her peers and rarely needs any verbal assistance from her special education instructor. By the end of the 8-week study, students were reflective thinkers and able to highlight strategies to help each other improve their work. These results corroborate findings from Sherrod, Dwyer, and Narayan (2009), which convey "performing these activities, students are nurtured in an environment that supports them in constructing a more comprehensive understanding of mathematics" (p. 255).

Core Theme Two: CL Instruction Increases Engagement and Math-Related Discussions

Every student described that working in CL groups to learn math made them become engaged and discuss mathematical concepts. The instructions gave them specific details to enhance understanding to complete the assignment. They really enjoyed the technology components and did not mind "talking through the answers to get it right" as stated by student 14B. Male student 4A stated that CL was like sports when learning the steps and liked being a part of the active learning. Students used math language and recorded math terminology for each of the 25 CL lessons. Diversity was promoted in the selection process of student groups. Students conveyed that getting to know other students in the class helped to make learning comfortable. This was explicitly stated in responses from Hispanic and American Indian students. Also, one White female student had not wanted to participate in a group but later stated she enjoyed group work. She now has one of the highest grades in the class and is quite talkative. This supports similar findings from Wu, Anderson, Nguyen-Jahiel, and Miller (2013), which convey, "The major finding of the two studies is that collaborative discussion enhanced children's motivation and engagement and increased their belief in the value of collaborative discussion as an environment for learning" (p. 629). The progressive pedagogy implemented throughout this research study provided a pathway for students to discuss mathematical ideas, enhance their motivation and have an equal opportunity to learn.

Core Theme Three: CL Increases Motivation

Students overwhelmingly showed in verbal description and actions of completed learning activities that they were more motivated to learn in the CL activities. Students taught each other the process of steps and shared their unique perspectives on how to solve problems. A female student with the highest average requested to partner with a special education student because she knew he was struggling. She was able to think about her responses to his questions and provide answers so that he could understand. This immediate feedback helped him become successful even though he had previously been in a self-contained classroom. Her process of thinking through solutions in order to help him benefited her own academic progress in that she rarely missed a test question. At one point, she had a perfect 100 average.

Peer tutoring and participant-researcher questioning/assistance allowed every student to be successful in each activity. There were 233 completed learning activities. Students said that they were able to stay focused even after lunch because they were actually completing the lesson themselves. After 3 days in middle block and 4 days in fourth block students immediately walked into the room and began working on their activities. When students are engaged, they rarely misbehave, so the class becomes self-managing. This fact alone is worth trying the activities for every class. This research corroborates findings from Pan and Wu (2013), which suggest that CL "instruction created a significantly positive promotion in the student learning motivation, particularly, in liking, dedication, self efficacy, and extrinsic motivation" (p. 22). The results are similar to previous findings by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), which convey, "Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101).

Core Theme Four: Egalitarian Principles

Equal opportunities were established at the beginning of the IMRP through character education and followed through by establishing instructions for each of the 25 CL activities. Every student-participant was required to explain their solutions or steps in the process of learning and given a role in learning for equal participation. Because of these requirements their social skills improved over the course of the 8 weeks and they began to enjoy working together. Two students, who almost changed classes due to extreme dislike, became good friends and now work as partners often. Every student through requirement from instructions had an equal voice and an equal opportunity to learn. CL activities promoted diversity through assignment of individual groups. The American Indian student who would not speak at the beginning of the course is now one of the class leaders with extensive knowledge of mathematics. She is often the first to respond and enjoys helping other students understand math concepts. This research corroborates findings from Tan, Macey, Thorius, and Simon (2013), which suggest that creating student-centered learning opportunities where peers mediate activities, "create a high level of engagement and promote equity, not only for students with significant disabilities in inclusive environments, but also for all students" (p. 10).

Core Theme Five: High-Quality Reciprocity

Students worked together toward a common goal for each of the 233 completed activities. They built social skills that will help them pursue their dreams in life because we live in a society dominated by these necessary skills. Every student was accountable for his or her part in completing activities and only one student challenged this idea. He was still accountable for his actions and accepted responsibility. Every student completed at least 18 CL activities with absences, in-school suspensions (ISS), and nurse visits recorded. As part of each activity, students were required to become actively engaged through discussion and solving problems. Each was assigned a role in the instructions so that they would become interdependent on their team members. If one was successful, they were all successful, which equated to hundreds of completed activities. Following the guidelines of successful CL instruction established by Johnson and Johnson (1999a), the groups were limited to two or three members. Small group size allowed students to maintain their identity, find an equal voice in discussions, and created a pressure for students to participate. Group processing improved the learning experience and helped student-participants gain in-depth understanding of math concepts. Even though these student-participants had rarely seen success in math, this was almost forgotten after the second lesson. Student-participants stopped saying that they were stupid and began thinking that they could accomplish their goals. Group processing was a requirement for every lesson either through discussing their mistakes and improvements, using their learning artifacts to increase understanding, or completing student perceptions and reflection surveys. As a participant in this study, the researcher was able to foster reciprocity among group members through inquiry in order to improve metacognition and reflective practice. Through CL activities, students were able to recognize misconceptions in the learning process and reflect with group members to make corrections. This finding is corroborated by Flowers (2015), whose research found, "By participating in their group projects, students applied social pressure to other group members who responded by reciprocating the work effort. As the term progressed, group members developed friendships. As these friendships increased, so did the cycle of reciprocation" (p. 205).

With confidence, these thousands of statements convey that students' perceptions of CL instruction improved over time. They became motivated, confident, and social during the 8-week study. They have built a foundation of knowledge and skills to be successful in their subsequent mathematics courses. Students 3A and 4A have been moved up to higher levels of math where they may go to a 4-year college upon graduation. A special education student, who had never been in regular math classes until this year, was successful. Student 2A transitioned from completing all assignments with a resource teacher to completing all assignments in the classroom, including summative assessments. She earned straight A's for both 9 weeks, a student of the quarter award, and an end of the year award for highly improved. Five female students flourished academically and vocally. Student 8B did not want to participate originally but became a peer leader after a couple of CL activities. She was over 18 years old in the ninth grade. The IMRP celebrates social justice by transforming two Intermediate Algebra classrooms into social, engaging, centers of learning that promote equality for all members through progressive pedagogy. Together all of the data support the idea that students enjoy learning through CL instructional groups and they were all successful.

Implications of the Data

CL instruction is a success story for improving remedial students' perceptions of learning mathematics. Empowering students to take responsibility in their own learning is important to enhance understanding and build a foundation of knowledge to become successful in math. This foundation of knowledge will heighten their chances for success in future math courses. The IMRP was organized so that each student learned through a social experience and was accountable through an assigned role. It was designed with egalitarian principles for learning mathematics. Rousseau (1979) describes a child's process of learning mathematics, "The physical sciences, like mathematics, physics, and astronomy, are human contrivances which, if solidly grounded on the pure experience of the senses, extend the range of the senses and protect them from the errors of the imagination" (p. 9).

The findings overwhelmingly displayed that students' perceptions of the IMRP, and ultimately learning math, improved greatly over the 8-week research study. Thousands of responses and comments convey that students' perceptions of CL instruction were positive. They became confident as they began to see success and developed increased understanding of math concepts. Students were motivated, as they became engaged in activities and ultimately became social, as they were required to discuss solutions with their partners throughout the 8-week course. They have built a foundation of knowledge and concepts to be successful in their future mathematics courses. Two student-participants have moved to higher levels of math next year where they are on track to attend 4-year colleges upon graduation. A special education student was successful in the IMRP. Both males and females indicated CL groups improved their understanding of math content and motivated them to learn. All racial categories indicated that CL groups strongly enhanced their understanding of math content. There was no indication of growth differences to differentiate gender or race. Together all of the data support the idea that students enjoy learning through CL instructional groups and they were all successful. These results are similar to previous studies (Sherrod, Dwyer, & Narayan, 2009; Veloo, Md-Ali, & Chairany, 2016; Wu, Anderson, Nguyen-Jahiel, & Miller, 2013) that are indicated in each of the core themes above.

Conclusion

The goal of the present action research study has been to understand students' perceptions of an IMRP, use this knowledge to improve pedagogical practices within my classroom, and then build an IMRP to improve student learning for the high school. The participant-researcher was able to redirect behavior and alter the path of activities so that each student achieved understanding of concepts and become successful in algebra. As a insider-researcher, she guided students through instructional activities, captured in-depth details of students' perceptions of the IMRP, reflected with student-participants to improve student learning, and discussed emerging themes with student-participants. As an outsider-researcher, she developed the IMRP, created CL instructional activities aligned with state standards, analyzed data to discover emerging themes, reflected through memoing in field notes, collaborated with members of the Intermediate Algebra PLC to build a team of support for cycle two, and shared findings with administration.

Remedial students need opportunities to become interested in core disciplines such as mathematics. They should take responsibility in their own learning and build a foundation of knowledge to become successful in math. Altering the classroom environment through assessing students' perceptions improves the culture of learning and thereby increases understanding of content. Students conveyed with highest overall agreement that they were more comfortable communicating math concepts they do not understand, understand math concepts more, attempt to participate equally, and are more likely to complete math assignments in a CL group. Students' perceptions about math improved over the 8-week study. Egalitarian principles were established and promoted social justice for every student-participant in the research study. The data analysis revealed that no growth differences existed through disaggregation of data by gender or race. Instead, the findings revealed that both males and females stated that cooperative groups improved their understanding of math content and motivated them to learn. All racial categories collectively indicated that CL groups strongly enhanced their understanding of math concepts.

There are often many challenges when working with remedial students, and attitude is typically one of them. When implementing CL instruction, students know from onset of the course that the focus of attention will remain on instruction and assisting students to reach their greatest potential. Students who do not participate in activities are sent to a buddy room with work to complete. It is their last opportunity to make the right decision before they are sent to discipline. Because of this agreement in learning, students rarely leave the room. They simply do their work.

At the midpoint of the semester, one male student decided to challenge this rule. Instead of doing his work, he simply walked out of the room and went straight to discipline. When he returned the next day, I greeted him as if nothing happened and provided him a new seat with a new partner. Disliking this change, he walked out again.

No other words were exchanged. When he returned the following day, he had a new attitude and I greeted him as if nothing happened. He accepted his new seat this time and worked to complete the entire activity. He was asked to leave the room one additional time but no other difficulties occurred. The teacher cannot allow "unruly and non-participating pupils to stand permanently in the way of the educative activities of others. Exclusion perhaps is the only available measure at a given juncture" (Dewey, 1997, p. 57). Student 5B was the most challenging student of the study (see Appendix G). His Likert survey responses convey that while he does not like learning math, he knows that the activities "strongly enhance his understanding of concepts," "make him more likely to complete his math assignments," "engage in math-related discussions," "attempt to participate equally," and "allow him to feel more comfortable communicating what he does not understand." Many students conveyed these same ideas through interviews, reflections, field notes, and Likert surveys responses. Intermediate Algebra is a challenging course for remedial math students. The course incorporates many difficult Algebra II concepts and is completed with a standard end of course exam that encompasses all SCCCR standards from Algebra I. The only way to adequately prepare these students is to find creative ways for them to learn. Students who participate in their own learning and are given an equal voice may persevere to accomplish their goals. The results overwhelmingly convey positive student perceptions of the IMRP.

At the end of the first 8 weeks, every student was successful, including the student who was previously in self-contained courses. A Black female and a Black male student had the highest averages in both classes, respectively. Both had their individual graduation plan (IGP) conferences and were placed on the college preparatory track next year with higher-level mathematics. Their guidance counselors stated their increases were quite high and future honors courses were discussed.

CHAPTER FIVE: SUMMARY AND CONCLUSIONS

> Challenging children's perceptions of mathematics enabled them to be more flexible in their learning. Allowing children to contribute so much to their own learning encouraged feelings of autonomy, which is important for increased interest and perseverance. (Bonnett, Yuill, and Carr, 2017, p. 92)

Introduction

The purpose of Chapter Five is to chronicle a summary and conclusions of this action research study concerning students' perceptions of the Interactive Mathematics Review Program (IMRP) that was developed to help remedial students learn algebra in a cooperative setting. The conceptual framework established by the preceding studies was strictly adhered to in this research to provide the greatest opportunities for success. Each cooperative learning (CL) group activity was designed under specific conditions that established the following six objectives: (1) positive interdependence; (2) accountability; (3) interpersonal skills; (4) promotive interaction; (5) group processing (Johnson and Johnson, 1999a), and (6) egalitarian principles (Kagan, 2014). These criteria assisted the participant-researcher to design the IMRP so that every student could become successful in math.

The obstacle was that students were arriving to high school with negative perceptions of math and high failure rates from previous math courses (see Appendix A). This combination left many students with low self-esteem and perceptions of learning.

The research explored CL instruction through establishing an IMRP and metacognitive reflection on students' perceptions for learning math content and worked to alter negative feelings about math. This study highlights these students' perceptions of the IMRP through progressive pedagogy and explored differences in gender and race. Students' comments will be used to improve the IMRP in a cyclic approach and develop a nine-step action plan for the fall of 2017.

Problem of Practice (PoP) Statement

The identified problem of practice for the present Action Research study involves ninth- and tenth-grade student preparation for remedial mathematics courses at a southern suburban high school of 1,936 students in a low-SES environment (Annie E. Casey Foundation Kids Count data, 2015). In 2016, the majority of these entry-level students began the year with remedial courses to meet the demands of their credit-bearing mathematics courses. Even then, failure rates among these children were high. According the high school report card (2015), 40% of the students enrolled in Cymax High School (CHS) received free or reduced lunch.

The concepts of mathematics (i.e., in this study Algebra) are cumulative, and a foundation of knowledge from the previous class is essential to be successful in subsequent classes. Students who have discontinuity of knowledge are not able to perform mathematics concepts at the next level. Using CL strategies to improve student learning of algebraic concepts allows the student to build a solid foundation of skills in order to be successful in their current class and higher mathematics classes as well. Over the 2015-2016 school year CHS documented a large increase in failure rates among ninth-grade students in algebra (see Appendix A). Many arrive as ninth graders with little interest in math, low self-esteem, and few of the necessary skills to be successful, according to the high school. Therefore, the participant-researcher designed a review program (in the form of an IMRP) for ninth- and tenth-grade students to enable them to meet some of the challenges they will face in secondary education.

Research Question

The research question established the need for greater understanding and intentional investigation of ninth- and tenth-grade students' perceptions of an IMRP to enable these students to understand how to work in CL groups to improve student learning of algebraic concepts. The following research question assisted the participant-researcher to narrow the focus of the research, improve student learning, and collect data: "What are ninth-grade and tenth-grade remedial mathematics students' perceptions of an Interactive Mathematics Review Program?"

Purpose Statement

The primary purpose of the present action research study was to describe ninth- and tenth-grade students' perceptions of an IMRP designed by the participant-researcher to improve student learning of algebraic concepts by engaging students in CL group activities. The secondary purpose was to design an action plan in concert with student-participants' perceptions in order to collaborate with teachers in a professional learning community at CHS to develop CL strategies for their students who struggle with mathematics classes. The IMRP enabled students to work in cooperative teams to build interdependent social relationships with peers at similar levels to their own level of ability as well as to enrich their academic performance.

Participants

The action research study was implemented during the spring semester of 2017 with 21 students enrolled in two Intermediate Algebra classes. CHS (2016) data show that 48% of the students enrolled in the participant-researcher's two Intermediate Algebra course received free or reduced lunches. Additionally, 14 of the 21 student-participants had failed at least one previous math course, so most of these students had negative perceptions for learning mathematics. These students were typically 15 to 16 years of age, however, two were over 17 and three were over 18 years of age. Students were of similar abilities since they were in the same level mathematics course. Every student provided consent and a desire to be placed into the study. In middle block Intermediate Algebra, there were 4 male and 4 female students of which 5 were Black, 1 was Hispanic, 1 was American Indian, and 1 was White. In fourth block, there were 4 males and 10 female students of which 9 were White, 3 were Black, and 1 was Hispanic. Only 7 of the 21 students have been successful in all previous math courses. One student-participant completed the previous course through credit recovery. Within the two classes, 9 of the 21 students had a learning disability or received special accommodation for learning mathematics. Three had additional physical impairments. One student-participant is an English-language learner (ELL).

The Setting

CHS is situated in a large southern, low-SES community of the school district and contains 1,936 students (Annie E. Casey Foundation Kids Count data, 2015). Data retrieved from Kids Count (2015) state that the school is comprised of 70% White, 21.4% Black, 6.3% Hispanic, 1% American Indian, and 1.3% Asian/Hawaiian/Pacific Islander.

According to High Schools (2015) data, approximately 40% of students enrolled in CHS receive free or reduced lunch (para. 9). These data indicate that the high school could become eligible for Title 1 funding.

Data Collection Analysis and Coding

The constant comparative method (CCM) was used to describe, conceptually code, and categorically organize the collected data in order to generate the emerging themes (Glaser & Strauss, 1967; Mertler, 2014). This action research study benefited from CCM as separated from grounded theory (Fram, 2013) because the participant-researcher only intended to improve the pedagogical practices within her own classroom, high school, and district. Mertler (2014) asserts, "Action research allows teachers to study their own classrooms…in order to better understand them and to be able to improve their quality or effectiveness" (p. 4). This research study does not seek explain real world theories, an element of grounded theory. According to O'Connor, Netting, and Thomas (2008):

> It must be clear that constant comparison, the data analysis method, does not in and of itself constitute a grounded theory design. Nor does the process of constant comparison ensure the grounding of data whether 'grounding' is used in a positivistic or interpretive sense. Simply put, constant comparison assures that all data are systematically compared to all other data in the data set. This assures that all data produced will be analyzed rather than potentially disregarded on thematic grounds (p. 41).

This action research study supported O'Connor et al.'s (2008) assertion of CCM analysis. Further investigation into the conceptual framework revealed the need to separate the qualitative data analysis (QDA) and grounded theory (GT) in order to avoid what Glaser and Horton (2004) argue:

> The mixing of QDA and GT has the effect of downgrading and eroding the GT goal of conceptual theory. The result is a default remodeling of classic GT into just another QDA method with all of its descriptive baggage (p. 2).

Glaser and Horton's argument supports the separation of CCM analysis from GT and provides a strengthened method of analysis for this action research study. The educational focus of this study maintains emic perspectives (the viewpoints and perceptions of student-participants as insiders). Additionally, the participant-researcher integrates emic and etic perspectives (as and insider and an outsider/observer) in order to improve understanding and apply continual reflection throughout the research. As an insider, the participant-researcher assisted groups through instruction using inquiry, established positive interdependence, accountability, and egalitarian principles between group members. As an outsider, the participant-researcher developed the IMRP, created CL instructional activities based on SCCCR (2015) standards, identified CL groups, observed instruction, analyzed data to discover emerging themes, and reflected through memoing in field notes. Through observations, interviews, evaluations, and reflections (Mertler, 2014, p. 20), the participant-researcher was an insider and an outsider in this action research study (Schramm-Pate, 2016).

Qualitative data collection served as the primary data source in the form of field notes from observations, semi-structured interviews, questionnaires, student reflection surveys, and a focus group interview. Since polyangulation is critical to answer the research question completely, quantitative data from Likert surveys were collected as a secondary source. Yin (2009) argues that data are more persuasive and precise if they are polyangulated from “several different sources of information” (p. 116).

Findings of the Study

The student-participants were given 25 CL instructional activities during an 8-week period in the spring of 2017. Semi-structured interviews captured in-depth details about students’ perceptions and feelings at three points in time. Student self-evaluation and reflection as well as Likert surveys provided additional information of students’ perceptions in order to polyangulate the data. It is important to polyangulate the data because it allows the action researcher to improve accuracy of data through cross-reference (Mertler, 2014; Mills, 2011). A code list was generated and the characteristics of the phenomena displayed five core themes: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) egalitarian principles; and (5) high-quality reciprocity. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students became social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). Students, “no longer only concentrated on their own learning but instead shared their mathematics understanding with their team members as well as their other classroom peers” (Veloo, Md-Ali, & Chairany, 2016, p. 119). Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), “Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101). The progressive pedagogy implemented in this action research study improved students' perceptions of learning mathematics and the results indicated improved student learning.

Reflection. All study participants continually reflected for improvements. The participant-researcher and student groups reflected upon CL instruction after each of the 25 activities through verbal or written statements. Students' perceptions were captured in the participant-researcher's journal in the form of memoing. Students' self-reflection surveys were collected at three points in time. A focus group interview was conducted after all 25 CL activities were completed. The participant-researcher disaggregated the data by gender and race.

Interpretation of the Findings

CL instruction is a success story for improving remedial students' perceptions of learning mathematics. Empowering students to take responsibility in their own learning is important to enhance understanding and build a foundation of knowledge to become successful in math. This foundation will heighten their chances for success in future math courses. The IMRP was organized so that each student learned through a social experience and was accountable through an assigned role. It was designed with egalitarian principles for learning mathematics. Rousseau (1762/1979) describes the child's process of learning, "If solidly grounded on the pure experience of the senses, extend the range of the senses and protect them from the errors of the imagination" (p. 9). The findings overwhelmingly displayed that students' perceptions of the IMRP and ultimately learning math improved greatly over the 8-week research study.

Thousands of responses and comments convey that students' perceptions of CL instruction were positive. They became confident as they began to see success and developed increased understanding of math concepts. Students were motivated as they became engaged in activities and ultimately became social. They were required to discuss solutions with their partners throughout the 8-week course in every CL activity. They have built a foundation of knowledge and concepts to be successful in their future mathematics courses. Two have moved to higher levels of math next year where they are on track to attend 4-year college upon graduation. A special education student, who had never been in regular math classes until this year, was successful. Together all of the data support the idea that students enjoy learning through CL instructional groups and they were all successful. Slavin (2014) asserts that CL instruction has the power to transform a classroom "from remedial to advanced" (p. 26).

Key Questions

Several key questions emerged as the participant-researcher sought to improve the IMRP for cycle two:

(1) Proper implementation of the IMRP will be critical to the success of the program as it expands. How could the Action Plan include specific steps, utilizing the established conceptual framework, to eliminate difficulties so that every student and teacher could be successful?

(2) What actions are necessary to improve students' mathematical proficiency as well as leadership reciprocity?

(3) Teaching remedial students to reflect was challenging. Why are student-participants struggling to reflect and what can be done to improve their reflective practice?

(4) Attendance was a challenge to the IMRP. Could the leadership team expand the IMRP so that students could participate in instructional activities in different Intermediate Algebra classrooms during their independent learning time (ILT)?

(5) Interactive personalized group instruction was highly effective in two of the 25 CL instructional activities using iPads. At students' requests, how could curriculum be developed integrating more technology to improve conceptual understanding?

Action Researcher

The action researcher for this study is a curriculum leader and paid curriculum developer from the district office mathematics department. She is a Student Government Senior Class Adviser, Key Club Cosponsor, Capturing Kids' Hearts leader, and Renaissance sponsor to improve the culture within the school. She has been asked to mentor new teachers through training on classroom management and disciplining students in August 2017. Progressive pedagogy of CL instruction is an asset to share with these new teachers and assist them to become great classroom leaders.

The curriculum leader as the participant-researcher collected data during an 8-week period in the spring of the 2016-2017 school year with 21 student-participants. The IMRP was implemented to improve student-learning experiences and capture in-depth details about students' perceptions in order to answer the research question completely. Qualitative data collection served as the primary data source in the form of field notes from observations, semi-structured interviews, questionnaires, student reflection surveys, student artifacts, and a focus group interview. Quantitative data from Likert surveys were collected as a secondary source in order to polyangulate the data (Mertler, 2014; Yin, 2009).

The Constant Comparative Method (CCM) was used to describe, conceptually code, and categorically organize the collected data in order to generate the emerging themes (Glaser & Strauss, 1967; Mertler, 2014). This action research study benefited from CCM as separated from grounded theory (Fram, 2013) because the researcher intended to improve the pedagogical practices only within her own classroom, high school, and district. Reflection was critical to improve subsequent cycles of the IMRP. The participant-researcher and student groups reflected upon CL instruction after each of the 25 activities through verbal or written statements. Students' perceptions were captured in the participant-researcher's journal in the form of memoing.

Students' self-reflection surveys were collected at three points in time. A focus group interview was conducted after all 25 CL activities were completed. The participant-researcher reviewed each completed formative assessment by first reviewing students' reflections to eliminate researcher bias. Mather and Wendling (2009) contend, "[L]anguage plays an active role in the creation of thought. Thus the ability to put thoughts into writing helps children develop, clarify, and structure their ideas" (p. 37).

Student-participant reflections improved over the 8-week study. When students were struggling, they were asked to discuss questions like "how activities were completed" and "how they could be improved" with their partner. A plan for improved reflection in conjunction with student-participants' perceptions of the IMRP will be included in the second cycle of the IMRP.

Throughout the process of analyzing the data and reflecting with student-participants, the main challenge was ensuring that the correct themes emerged from their responses. It was not until the data were polyangulated with the quantitative Likert surveys that this information was confirmed. Those surveys complemented every insight the participant-researcher had into students' perceptions of the IMRP. "In order to foster students' metacognition and critical thinking, educators need to create learning environments where students are allowed to explain and defend their thinking, opinions and decisions" (Tsai, 2001, p. 972). The IMRP was designed to fulfill this need, improve pedagogical practices in the classroom, and improve students' perceptions of learning mathematics.

For the second cycle, a network of support for the IMRP is first established, beginning with a team of remedial mathematics teachers in a PLC. Findings and newly developed curriculum will be shared with administration, the district mathematics coordinator, the PLC and eventually across the district. Mertler (2014) asserts, "Sharing the results of research studies also provides an opportunity for teacher-researchers to gain additional insight into their study and ultimate findings" (p. 265). At the completion of the IMRP cycle two, the participant-researchers' leadership team will compare findings and lead professional development to transfer knowledge across disciplines. This process will be cyclical as she works to expand the team of professionals and collectively the leadership team reflects for improvements of the program.

Insider/Outsider Status

The participant-researcher is an insider-researcher in that she: (a) guided students through instructional activities with expertise in algebraic content and knowledge where student-participants struggle through content presented; (b) captured in-depth details of students' perceptions of the IMRP; (c) reflected with student-participants to improve student learning; (d) discussed emerging themes with student-participants; and (e) grew up in a low-income, low-SES community with a great understanding of the issues these students face each day. Merton (1972) asserts that the only through authentic knowledge may the participant-researcher truly understand the culture of the environment through the unique perspective of experience. Additionally, insider-researchers may be able to collect more in-depth data sets through a unique knowledge of shared experiences with student participants, according to Dwyer and Buckle (2009). Merton (1972) continues:

> There is a special category of people in the system of social stratification who have distinctive, if not exclusive, perceptions and understanding in their capacities as *both* insiders and outsiders…. [They are insiders as outsiders] who have been systematically frustrated by the social system. (p. 29)

The participant-researcher as an outsider is an objective observer who knows the benefits of increasing passing rates for this course and altering the course of the lives of these lower-level students. Reardon (2011) of the Center for Education Policy Analysis at Stanford notes, "The achievement gap between children from high- and low-income families is roughly 30 to 40 percent larger among children born in 2001 than among those twenty-five years earlier" (p. 91).

The participant-researcher is an outsider-researcher in that she: (a) developed the IMRP; (b) created CL instructional activities aligned with state standards; (c) analyzed data to discover emerging themes; (d) reflected through memoing in field notes; (e) collaborated with members of the Intermediate Algebra PLC to build a team of support for cycle two; and (f) shared findings with administration. This research study is designed to increase passing rates and close the achievement gap among these algebra student-participants at CHS.

Challenges. The participant-researcher encountered several challenges through implementing the IMRP. The main concern was student attendance. There were 45 student absences in the two Intermediate Algebra classes over the 8-week study (see Appendix D). Additionally, lengthy nurse visits and students in ISS reduced the study by eight CL groups. Rolka and Remshagen (2015) assert that student attendance is a strong indicator for student success. In order to ensure that student attendance was sufficient to implement the IMRP, more CL activities were included so that each student participated in at least 18 CL activities. Subsequent cycles should address attendance concerns with parents/students and its importance for student success.

A second challenge was that one student was extremely uneasy about working in groups and stated she would not work with anyone. So, on the first CL activity student-participants were placed in a semi-circle where all were equal for first CL activity. It was highly effective at placing the students at ease. The participant-researcher discovered she was over 18 years old in the ninth grade. She became peer leader and worked well in groups. Her conceptual understanding highly improved and her grades moved from C’s to A’s.

A third challenge was teaching remedial students to reflect in order to improve student learning. These students have rarely seen success in math courses and many have negative perceptions of learning math. Student-participants were making comments like, “I am stupid” and “I am not good at math.” During the first few of lessons, students were uneasy about working in groups and were just learning to become interdependent on their team members. Many were passive and not as vocal at that time. In addition, each of the activities presented was designed through directions for students to describe the process of finding solutions to problems. For many students, it was the first real effort they had put forth to learn math. Instead of helping each other learn, student-participants were raising their hands to ask the participant-researcher questions. They were quite frustrated when they were not instantly gratified with answers. Not only were they struggling to learn the new math concepts, they were struggling to describe how to correct their mistakes. The participant-researcher used inquiry techniques to help student-participants solve their own problems and become team members.

Group processing and reflection were requirements for each of the 25 lessons either through discussing their mistakes and improvements, using their learning artifacts to increase understanding, or completing student perceptions and reflection surveys. As students grew more confident and found success, their reflections improved. The IMRP sought to alter students’ perceptions of learning math concepts in a positive manner. A goal of the next cycle is to train students to make deeper connections to why their mistakes occurred. The leadership team will ask student-participants to model reflections to train team members to apply cognitive thought for what could be improved in each lesson. PLC leadership team members will use inquiry of learning mathematical concepts and open-ended questioning techniques to further reflective practice in concert with student-participants perceptions of the IMRP model. Step four of the action plan addresses this challenge to improve student-participants' reflective practice.

A fourth challenge was one male student 5B (see Appendix G). He was the most challenging student of the study. His Likert survey responses conveyed that while he does not like learning math, he knows that the activities "strongly enhance his understanding of concepts," "make him more likely to complete his math assignments," "engage in math-related discussions," "attempt to participate equally," and "allow him to feel more comfortable communicating what he does not understand." He walked out of class twice and was sent out once, argued that the class was moving too quickly, and contended that it was too much work. Learning is not optional although he was allowed to work independently. He chose not to work at all which was not an option. After contacting parents and one of his other teachers, the student worked pretty well in CL groups. Some students today are accustomed to instant gratification through direct instruction. The teacher-centered method often allows students to become lazy and receive answers without effort. Through the implementation of CL strategies and other progressive pedagogies, students sometimes rebel against having to put forth great effort to learn.

Developing an Action Plan

Findings suggest that the IMRP promoted positive students' perceptions by establishing CL instruction so that every student, even those with learning disabilities, could achieve success. The program promoted greater comprehension of math concepts, increased engagement and math-related discussions, increased motivation to complete assignments, and promoted high-quality reciprocity through student-led peer tutoring. The program was highly influential to increase student discussion and reflection. Student 10B stated, “My people think like I think. Sometimes teachers do not understand the questions I am asking. I like learning like this.” Through the IMRP, a special education student became successful in the regular math classroom.

The IMRP Promotes Social Justice. The program provided every student equal opportunities to learn and have a voice in classroom discussions. Student 3A, a Black female, and student 4A, a Black male, had the highest grades in both classes. In the 2017–2018 school year they will both be placed in higher math classes and on the college preparatory track. This was a great concern that these students were very high achieving and had never been promoted into more advanced coursework. Student 2A transitioned from completing all assignments with a resource teacher to completing all assignments in the classroom, including summative assessments. In addition to earning straight A’s for both 9 weeks, she earned a student of the quarter award and an end of the year award for highly improved.

Action Research Plan Timeline for the IMRP Cycle Two. The following timeline delineates the Action Plan for the 2017-2018 school year at CHS.

Summer 2017: Develop curriculum of CL instructional activities aligned with state standards that follow pacing guides of Intermediate Algebra. Share with administration, district mathematics coordinator, and members of the PLC.

August 2017: Implement the IMRP cycle two with four members of the PLC. The PLC will: (1) develop the curriculum; (2) assess student needs; (3) build conceptual framework; (4) plan for reflection; (5) communicate with parents; (6) collaborate with

PLC to implement the IMRP; (7) monitor the IMRP and continually reflect for improvements in concert with student-participants; (8) describe revisions; and (9) lead professional development.

December 2017: Compare results of each IMRP cycle and share with administration.

January 2018: Implement the IMRP cycle three with all remedial level teachers at CHS.

Action Plan: Nine-Step Development of the IMRP Cycle Two

After assessing the findings, challenges, and improvements of the IMRP from cycle one in conjunction with the student-participants through reflective practice, a second cycle of the IMRP to improve student learning is planned for the fall of the 2017-2018 school year. Permission was granted from the principal to conduct the research and follow up by discussing the results with him. Strong leadership is essential for the IMRP to develop into a district-wide initiative to improve students' perceptions about learning math, decrease failure rates, and increase motivation in order to improve student learning. The following nine-step Action Plan was established to transition the curriculum implementation smoothly and foster a cohesive unit for curriculum leader and her leadership team.

Step One: Develop CL Curriculum for Intermediate Algebra. In the summer of 2017, Intermediate Algebra has established a PLC of four math teachers. As the curriculum leader, the participant-researcher is working to develop CL curriculum, in conjunction with students' perceptions of the current IMRP, which aligns with the SCCCR (2015) standards and follows the Intermediate Algebra pacing guides. The curriculum lessons are finalized with PLC members as the leadership team for CHS. The PLC members have already discussed the IMRP and will meet weekly in the fall of the 2017-2018 school year to implement the IMRP for cycle two. Specific challenges of the previous IMRP and how they were addressed will be discussed.

Step Two: Collaborate within the PLC to Assess Students' Needs. Conducting a students' needs assessment provides a guideline for teacher preparation necessary to help these students achieve success. Every teacher has online access to student transcripts in order to assess students' needs, although some data may not be visible and must be requested. Transcripts reveal positive and negative student learning experiences from previous courses as well as students' strengths and weaknesses. Ages of student-participants will be recorded since 5 of the 21 student-participants in IMRP cycle one were above the age of 17. A plan for accommodating students with learning disabilities and non-English speaking students will be established. Including the ELL student, 10 of the 21 current student-participants received special accommodations. All except two were true remedial level students. After assessing students' needs, groups are purposefully chosen to be academically and culturally heterogeneous in order to broaden students' perspectives. Students are also checked individually to ensure they have passed the prerequisite course, Foundations in Algebra. The PLC leadership team will assess students' needs in conjunction students' perceptions of the IMRP continually through reflective practice.

Step Three: Conceptual Framework. The conceptual framework established a platform for the participant-researcher to create student-centered CL opportunities where students work through activities to learn concepts and make connections to the real world. The IMRP strictly followed previous theorists in order to increase every student's chance for success. The leadership team will discuss that CL instruction is not simply group work and must be based on the six objectives delineated by the experts. CL maximizes learning potential for every student. Johnson, Johnson, and Smith (2007) convey, "The purpose of cooperative learning is to make each member a stronger individual…. Students learn together so that they can subsequently perform higher as individuals" (p. 23). Primary and secondary sources focusing on progressive education and CL strategies assisted the researcher in strengthening the research design of the study.

Progressive Education. Dewey (1916) believed in the movement toward progressive education where learning naturally results through students' formative experiences. He believed that children should learn through active participation in instruction. His research implies that student motivation would increase if the lessons were relevant to the students' interests. The teacher only serves to guide instruction. Dewey promoted CL where the student would create a deeper cognitive connection through small group, kinesthetic instruction. Rousseau (1762/1979) believed in progressivism where students are not submissive learners but rather learn through active participation and being engaged in activities. The teacher serves to develop activities that guide students through natural exploration using his/her senses in order to learn. Pestalozzi (1912) believed in progressive education and contended that a child who learns through memorization is not able to go on to difficult mathematical skills until he/she understands the concepts.

Cooperative Learning Theory. Johnson and Johnson (1999a) defined CL as small group instruction where students are active participants, which results in increased understanding of concepts. They convey five objectives of CL: (1) positive interdependence; (2) accountability; (3) building interpersonal skills; (4) active learning; and (5) group processing. Kagan (2014) emphasized the importance of equal participation in learning where every student benefits from instruction. His research provided insight to establish a sixth objective for this research study, (6) egalitarian principles. He contends that every student can be successful when CL instruction is implemented. Slavin and Madden (1989) convey CL arranges specific interactions for students placed in small groups to acquire knowledge through application of metacognitive skills and reflect for improvements in subsequent activities.

Step Four: Plan for Reflection. Teaching students to reflect on their learning was a challenge in the first cycle of the IMRP. During the first few lessons, students were uneasy about working in groups and were just learning to become interdependent on their team members. Many were passive and not as vocal at that time. In addition, each of the activities presented was designed through directions for students to describe the process of finding solutions to problems. Instead of helping each other learn, student-participants were raising their hands to ask the participant-researcher questions. They were somewhat frustrated when they were not instantly gratified with answers. Not only were they struggling to learn the new math concepts, they were struggling to describe how to correct their mistakes. The participant-researcher used inquiry techniques to help student-participants solve their own problems and become team members.

Group processing and reflection were requirements for each of the 25 lessons either through discussing their mistakes and improvements, using their learning artifacts to increase understanding, or completing student perceptions and reflection surveys. As students grew more confident and found success, their reflections improved. In the second cycle, students are trained to reflect on their learning and growth for each activity. The leadership team will ask student-participants to model reflections to train team members to apply cognitive thought for what could be improved in each lesson. The leadership team will highlight these insights into students' perceptions of the IMRP to improve reflective practice. PLC leadership team members will use inquiry of learning mathematical concepts and open-ended questioning techniques to further reflective practice. The PLC will discuss improvements for reflections and group processing weekly in conjunction with ideas from student group members. To extend reflective practice, students are then asked to measure their learning based on the "I can statements" for each lesson. These statements are visible to every student each day of what they should know and be able to do for each lesson. After student-participants complete reflections on each activity, they are asked to generate their own examples of problems to prepare for another group to answer. Student groups are also asked to present their answers to the class. In this way, students will build procedural fluency and ultimately mathematical proficiency of each standard to improve student learning. Reflective practice from the PLC leadership team is concurrent with students' perceptions of the IMRP as themes begin to emerge.

Step Five: Communicate with Parents. Communication with parents is vital to the success of the IMRP and a direction the high school is moving in to build a foundation of support for every student. Parents and student consent forms will be signed for the second cycle to bring awareness of the newly developed and cyclical program. Parents that are involved in their child's education typically promote higher academic achievement. Students who are aware that their parents have knowledge of the IMRP tend to work diligently and have a stronger work ethic for completing assignments. Connecting parents into the education system also enhances school improvement and support for clubs/activities that connect to academics as well.

Step Six: Collaborate to Implement the IMRP. The PLC as the leadership team, including the mathematics department chair, will collaborate to implement the second cycle of the IMRP in order to capture students' perceptions of CL instruction and improve student learning of algebraic concepts. Optimal leadership reciprocity will be continually re-examined. First, teachers will consider co-teaching with the participant-researcher for the first three activities in order to properly implement and reflect the IMRP. Second, the leadership team is required by administration to meet at least weekly, which supports reciprocity of the program, and teacher class schedules are designed so that planning aligns to support specific courses. For the 2017-2018 school year, students enrolled in Intermediate Algebra have increased and additional teachers are included in the PLC. The maximum number of students allowed per class has increased to 27 but in some cases this could be higher. As curriculum leader, the participant-researcher has prepared CL instructional activities that align with SCCCR (2015) standards and have explicit directions that outline the six objectives of CL instruction as stated in the conceptual framework.

Step Seven: Monitor the IMRP and Reflect for Improvements. Administration will assist evaluation and monitoring of teachers in the IMRP. During the current 8-week study, the participant-researcher was evaluated five times. Student performance will be measured in relation to the program implementation. Administration monitors student learning through academic achievement as well as a variety of other methods. The participant-researcher is concerned with students' perceptions to improve student learning primarily through qualitative data and polyangulated through quantitative Likert surveys. The IMRP will be continually refined in concert with students' perceptions of CL instruction as well as applied reflective practice from the leadership team math teachers.

Step Eight: Describe Revisions. In conjunction with students' perceptions of the IMRP and reflections from the leadership team members, revisions and improvements will be continually described and discussed within the PLC. Since the course is typically associated with higher numbers of students with learning disabilities or education plans, these students will be closely monitored and plans for learning revised for differentiated group activities. The PLC will monitor the necessary levels of support needed for each student. As challenges are encountered, the PLC will discuss each individually.

Step Nine: Professional Development. The results of this study, in concert with students' perceptions of the IMRP model, will be shared with other math teachers in a PLC, and a reciprocal plan to increase progressive pedagogy throughout the school for continually monitoring and assessing improvements in student learning will be the focus of expanding the IMRP. In concurrence with students' perceptions of the IMRP, reflective practice is necessary within the PLC to assess students' needs and to improve student learning of core concepts as well as refine the program. Leading professional development through a leadership team may redirect those teachers away from direct instruction and rote memorization for student learning. Leading as a team of professionals will not only provide a stronger commitment to the IMRP, but assist to celebrate successes. The IMRP described in this dissertation was a success story for improving student learning and promoting social justice. The program assisted students to reach their maximum potential.

Facilitating Educational Change

The IMRP was designed to facilitate positive educational change by describing ninth- and tenth-grade students' perceptions of this mathematics program to improve student learning of algebraic concepts by engaging students in CL group activities. Additionally, this Action Plan to collaborate with other teachers in a PLC at CHS to develop CL strategies for their students who struggle with mathematics classes will promote positive educational change for all remedial level students. The primary objective was to improve student learning to increase passing rates for remedial math classes. Many students described that CL group instruction strongly enhanced their understanding of mathematic concepts. After completion of the IMRP, administration was interested in the success of the program since the district leaders would like to implement more CL instruction. Communicating the results can strengthen a commitment to the success of the IMRP and move instruction away from direct instruction, an outdated strategy. The second phase of the IMRP, planned for fall of 2017, will train a team of new leaders to expand the program and establish a foundation of support. Coaching and mentoring these new teachers will be critical to maintain the original focus of the program and ensure the benefits of positive educational change are maximized. This iterative process will become “reciprocal, cyclical and interactive” (McEwen & Willis, 2002, p. 80).

Student-participants benefited from enhanced understanding of rigorous concepts and teamwork in CL groups to gain broader perspectives. Only 7 of these 21 student-participants had been successful in all previous math courses. Finding success in learning and being accepted into a group has improved their learning experience and built self-esteem for future successes. Slavin (2014) asserts that CL instruction has the power to transform a classroom “from remedial to advanced” (p. 26). CL changed the culture of the classroom and positively impacted the lives of these children. Student-participants stated they were more motivated to complete assignments, engaged in the learning process while engaging in math-related discussions, and enjoyed learning ideas from other students.

Summary of the Findings

The 21 student-participants were presented 25 CL instructional activities during an 8-week period in the spring of 2017. Semi-structured interviews captured in-depth details about students’ perceptions and feelings at three points in time (see Appendix B). Student self-evaluation and reflection responses as well as Likert surveys were also collected at three points in time and provided additional information of students’ perceptions in order to polyangulate the data (see Appendix C). Polyangulation is necessary because it allows the action researcher to improve accuracy of data through cross-referencing (Mertler, 2014; Mills, 2011).

All study participants continually reflected for improvements. The participant-researcher and student groups reflected upon CL instruction after each of the 25 activities through verbal or written statements, students' perceptions were captured in the participant-researchers' journal in the form of memoing, students' reflection surveys captured in-depth details about their feelings and beliefs, and a focus group interview was conducted after all 25 CL activities were completed. The participant-researcher disaggregated the data by gender and race. Findings were that five overarching themes emerged: (1) CL promotes greater comprehension; (2) CL increases engagement and math-related discussions; (3) CL increases motivation; (4) egalitarian principles; and (5) high-quality reciprocity.

The data analysis revealed that no growth differences existed through disaggregation of data by gender or race. Instead, the findings revealed that both males and females stated that cooperative groups improved their understanding of math content and motivated them to learn. All racial categories collectively indicated that CL groups strongly enhanced their understanding of math concepts. These findings corroborate current research, which suggests that CL can improve understanding of mathematics, promote communication, enhance active learning in mathematics, and create a student-centered learning environment where students became social in the process of their learning (Veloo, Md-Ali, & Chairany, 2016, p. 119). Students "no longer only concentrated on their own learning but instead shared their mathematics understanding with their team members as well as their other classroom peers" (2016, p. 119).

Further support to the findings of this research are contended by Fernandez-Rio, Sanz, Fernandez-Cando, and Santo (2017), "Cooperative Learning applied on a sustained basis can increase the most self-determined types of motivation, intrinsic motivation and identified regulation, in secondary education students" (p. 101). The findings are similar to previous research by Sherrod, Dwyer, and Narayan (2009), which convey, "performing these activities, students are nurtured in an environment that supports them in constructing a more comprehensive understanding of mathematics" (p. 255).

Suggestions for Future Research

As evidenced from this dissertation, teachers have great influence over designing curriculum, sharing knowledge in their field of expertise, and reflecting over the process in order to improve student learning. The participant-researcher would like to explore progressive pedagogy through CL curriculum development to increase mathematical proficiency in the IMRP through CL strategies for every student. Students should be able to strengthen conceptual understanding and build relationships between examples in order to solve problems observed in different contexts. In 2016-2017, the participant-researcher was instrumental in facilitating changes to promote teachers as leaders in professional development. It was discussed with the assistant principal/curriculum leader that CHS allow teachers to lead staff development with their best practices to improve instructional practices and thereby improve student learning. The program has been quite successful. Many aspects of this research such as additional CL strategies, mathematics lessons including active engagement of students, the impact on the social identities of 17- or 18-year-old students learning in the classroom with ninth-grade students, and improved student achievement in secondary education may provide implications for further research.

Conclusion

The IMRP, based on the conceptual framework of progressivism and CL theory, provides a rich basis for improving student learning and ultimately success for each of the 21 student-participants included in this action research study. Every student established a foundation of mathematical knowledge that provides greater chances of being efficacious in subsequent mathematics courses and in life. The participant-researcher structured each CL activity so that students were accountable to their group members for their role in the learning process, became positively interdependent on their peers, promoted the success of their individual team members, established an equal role and voice in the learning process, strengthened their social skills, and applied metacognitive reflection to improve the IMRP. The participant-researcher as an insider was able to capture in-depth details of students' perceptions and intervene so that every student could become successful while improving the learning process. Through the progressive pedagogy of CL instruction, student-participants were not submissive learners but rather experienced learning through engaging activities. The participant-researcher designed learning activities where each group was guided through an experience of natural exploration. This was evident as five overarching themes emerged. Findings suggest that CL instruction strongly enhanced understanding of mathematical concepts, increased engagement and math-related discussions, promoted equal opportunities to have a voice and experience in the learning process, increased motivation, and promoted high-quality reciprocity with peers of similar abilities. The IMRP was highly successful to improve student-participants' perceptions of learning math content and providing social justice for these learners with previous negative experiences in learning mathematics. This qualitative action research study addresses the problem of increasing failure rates for remedial mathematics students at CHS since all student-participants were successful in the IMRP at the end of the 8-week study. Many students flourished, as they never had before.

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APPENDIX A: FAILURE RATES FOR FOUNDATIONS IN ALGEBRA COURSE

*Note: This data include only Foundations in Algebra, a prerequisite course to the current Intermediate Algebra course. The IMRP was designed for remedial mathematics students.

Table A.1. *Failure Rates for Foundations in Algebra at Cymax High School*

Spring 2016 Foundations in Algebra Failure Rates	
Class 1	8 out of 19 were unsuccessful
Class 2	9 out of 15 were unsuccessful
Class 3	6 out of 19 were unsuccessful
Class 4	5 out of 20 were unsuccessful
Class 5	2 out of 20 were unsuccessful
Class 6	8 out of 17 were unsuccessful
Class 7	7 out of 20 were unsuccessful
Class 8	3 out of 24 were unsuccessful
Class 9	7 out of 22 were unsuccessful
Class 10	5 out of 26 were unsuccessful
Class 11	10 out of 23 were unsuccessful
Total	**70 out of 225** were unsuccessful

Failure percentage is approximately 31%

APPENDIX B: QUALITATIVE STUDENT INTERVIEWS

Semi-Structured Interview Guide:

1. Did participating in cooperative learning groups improve your feelings about math?
2. How did cooperative learning improve your understanding of the lesson?
3. Were you comfortable with the members of your group? If not, how could that be improved?
4. How did students in your group help each other learn? How it is set up.
5. Why did cooperative learning groups help you understand concepts you did not know during each lesson?
6. How did cooperative learning groups encourage you to work hard during each lesson?
7. Do you feel you were prepared for the formative assessments? Summative assessments?
8. Did the CL activities help you focus more while you were learning?
9. Do you feel the CL activities/Interactive Mathematic Review Program helped you struggle less to learn difficult concepts?
10. How could it be improved?

APPENDIX C: SURVEYS

Table C.1. Student Perceptions Survey

Student Perceptions of Cooperative Learning Techniques

The purpose of this questionnaire is to improve instruction. Specific statements about cooperative learning instruction are listed below. Use the bold code to describe how much you agree with each statement. Your responses will be anonymous; please do not place your name anywhere on this form. Please circle one number to respond for each statement and answer all questions. Thank you.

Please state gender:

1	**2**	**3**	**4**	**5**
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

1) I enjoy learning math.	1 2 3 4 5
2) I work well with others in a cooperative setting.	1 2 3 4 5
3) I understand math more when I work in cooperative learning groups.	1 2 3 4 5
4) I feel comfortable participating in cooperative learning groups to learn math.	1 2 3 4 5
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding.	1 2 3 4 5
6) I am able to help other students understand math concepts that I already understand.	1 2 3 4 5
7) Cooperative learning groups motivate me to learn.	1 2 3 4 5
8) I am more likely to complete my math assignments when working cooperatively.	1 2 3 4 5
9) I am more likely to engage in math-related discussions when working in a cooperative setting.	1 2 3 4 5
10) I attempt to participate equally when working in a cooperative group.	1 2 3 4 5
11) I am more comfortable communicating what I do not understand in a cooperative group.	1 2 3 4 5

Table C.2. Cooperative Learning Self Evaluation and Reflection Survey

Cooperative Learning Self-Evaluation and Reflection Please state gender:
Lesson topic:
Briefly describe how you contributed to today's lesson:
If you were completing this lesson again, what would you do differently? Could you improve your work?
How could your team improve working together for the next lesson?
How could you encourage other team members to do their best work?
After the lesson was completed, I still had a question about…
What was your favorite part of the activity?

APPENDIX D: COOPERATIVE LEARNING INSTRUCTIONAL STRATEGIES

Table D.1. Cooperative Learning Instructional Strategies

Cooperative Learning Strategy	Student Absences	Number of Groups
CL1 - Sage and Scribe Worksheet Activity – Solve equations with variables on both sides with follow up practice on iPad activity	3	9
CL2 – Solving equations explanations and Kahoot review activity	1	10
CL 3 - Solve linear inequalities (one and two step) and follow up with iPad activity	1	10
CL 4 – Solve multistep inequalities and follow up iPad activity	1	10
CL 5 – Review inequalities through Think, Pair, Share Review activity	1	10
CL 6 – Slope activity from a graph and from two points	3	9
CL 7 - Kahoot review slope from a graph and slope given two points	3	9
CL 8 – Slope-intercept form application from an equation, graph, two points, verbal and written description.	3	9
CL 9 – Slope-intercept form analysis with technology	3	9
CL 10 – Point-slope form from an equation, graph, two points, verbal and written description.	1	10
CL 11 – Graphing using intercepts and absolute value activity	1	10
CL 12 – Stained glass graphing activity	1	10
CL 13 - Flip book activity with 5 linear components	0	10
CL 14 – Writing equations of parallel lines (video component) and Kahoot Review **	2	9
CL 15 - Writing equations of perpendicular lines (video component) and Kahoot Review **	1	10
CL 16 – Graph linear systems by manipulating points interactive online activity (personalized group work)	1	10
CL 17 - Linear systems substitution interactive online activity (personalized group work)	4	8
CL 18 – Linear systems elimination interactive online activity (personalized group work)	6	7
CL 19 – Linear Systems Review Activity Worksheet and	1	10

Kahoot		
CL 20 – Families of functions TI – 84 Transformations Discovery Activity	1	10
CL 21 – Solve and Graph Absolute Value Equations and inequalities Activity (Parts of lesson are Absolute Value review)	1	10
CL 22 – Transformations of Absolute Value Functions (Determine the vertex, describe transformations and write an equation from a verbal description)	3	9
CL 23 – Evaluate Functions and Piecewise Functions Interactive Activity	1	10
CL 24 – Evaluate Functions from a Graph Activity and Quizziz Online Activity	1	10
CL 25 – Evaluate Functions Review Kahoot activity and Schoology Quiz **	1	10
Total	45	238
**3 additional groups were provided extended extra activities for personalized learning on the same topic when the lessons were completed quickly		+3
Total group activities		241
Less nurse visits and ISS		−8
Total group activities		233

APPENDIX E: PARENT LETTER

January 5, 2017

Dear Parent or Guardian:

My name is Crystal Wingard and I am enrolled in a course at the University of South Carolina Doctoral Program for Curriculum and Instruction. The program requires me to complete an Action Research project. The data from this research will be compiled and included as a written dissertation, which will be the culminating assignment for my degree. The completed project may be presented at a professional conference or for publication in a professional journal.

My research project is about the Impact of Cooperative Learning Strategies for Growth and Achievement with student learning.

During the school year, I will use activities, assignments, questionnaires, assessments, demographic studies and surveys to gather data or measure achievement related to this topic. All of the sample project materials will be available for your review upon request.

The purpose of this letter is to ask for your permission to include data gathered from your child in my proposed research project.

Your child will not be named in any material presented or published, and all information will be kept absolutely confidential and anonymous. All data will be stored securely during the study and destroyed upon completion.

I would appreciate your child's participation in this research. If you have any questions, please feel free to contact me.

Please return the attached permission form with your signature by the assigned date.

Thank you for your help.

Sincerely,
Mrs. Crystal Wingard, MAT Mathematics
Math Teacher WKHS
Math Professor Midlands Technical College

Mrs. Crystal Wingard

I understand that you are enrolled in a course that requires a research project that will be discussed in class and which could be presented at a professional conference and/or published in a professional journal.

I understand that you are asking for my permission to include my child's data in your research and that no child will be named in any resulting presentation or publication.

Choose one:

_____ I **GIVE** my permission for my child, ____, to participate in your research during the 2016–2017 school year.

_____ I **DO NOT GIVE** my permission for my child, __________________________________, to participate in your research during the 2016–2017 school year.

Parent/Guardian name (please print) Parent/Guardian signature

Date __________________

_____I **agree** to participate in the study.

Participant name (please print) Participant signature

Date _________________

APPENDIX F: STUDENT ASSENT FORM

January 5, 2017

Dear Student:

I am a doctoral student at the University of South Carolina, which requires me to complete an Action Research project. I will compile the completed project as a written dissertation, which will be the culminating assignment for my degree. The results of this action research study could be presented at a professional conference and/or published in a professional journal. This Action Research project will study the students' perceptions of an Interactive Mathematics Review Program (IMRP) in the Intermediate Algebra course.

During the school year, I will use interviews, surveys, activities, assignments, and demographic studies to gather data or measure perceptions and learning outcomes related to this Cooperative Learning instruction. If you do not want to participate in this Action Research study, there will be no penalty and your grade will not be adversely affected. Your participation in this Action Research study is voluntary and you have the right to change your mind and stop participating in this study at any time. Your name or image will not appear in any of the material that is presented or published. All data will be stored securely during the study and destroyed within one year of completion of the project.

I would appreciate your participation in this research. If you have any questions, please feel free to contact me at 803-821-5331 or cwingard@lexington1.net.

Thank you,
Crystal B. Wingard

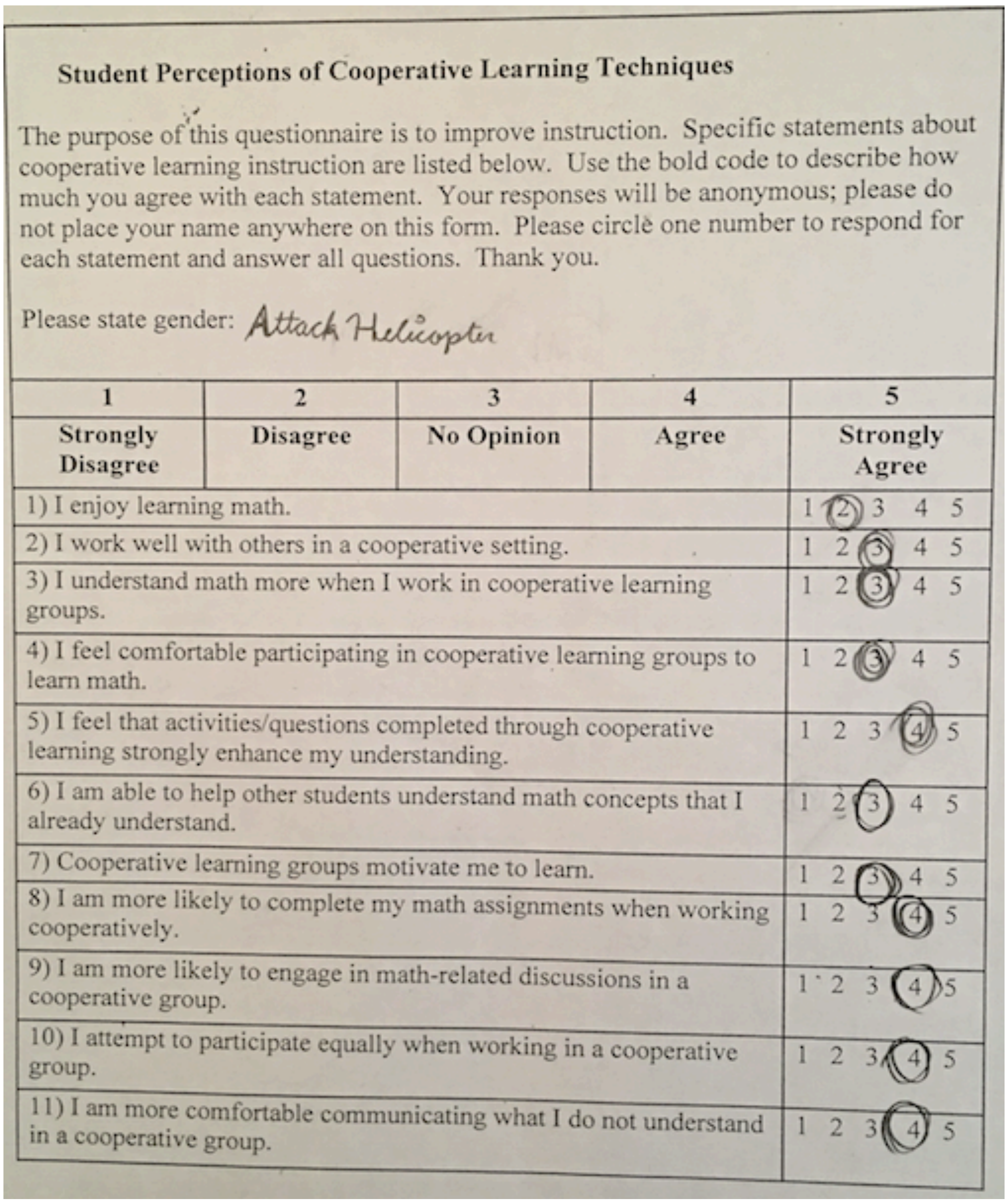
___________ **YES.** I agree to participate in this action research study. I understand that this study will be completed during class time and that even if I agree to participate, I can change my mind later.

___________ **NO.** I do not want to participate in the study.

Student Name: ______________________________________

Student Signature: ________________________________ Date: _____________

APPENDIX G: STUDENT 5B LIKERT SURVEY RESPONSE



Student Perceptions of Cooperative Learning Techniques

The purpose of this questionnaire is to improve instruction. Specific statements about cooperative learning instruction are listed below. Use the bold code to describe how much you agree with each statement. Your responses will be anonymous; please do not place your name anywhere on this form. Please circle one number to respond for each statement and answer all questions. Thank you.

Please state gender: Attack Helicopter

1	2	3	4	5
Strongly Disagree	**Disagree**	**No Opinion**	**Agree**	**Strongly Agree**

1) I enjoy learning math.	1 2 3 4 5
2) I work well with others in a cooperative setting.	1 2 3 4 5
3) I understand math more when I work in cooperative learning groups.	1 2 3 4 5
4) I feel comfortable participating in cooperative learning groups to learn math.	1 2 3 4 5
5) I feel that activities/questions completed through cooperative learning strongly enhance my understanding.	1 2 3 4 5
6) I am able to help other students understand math concepts that I already understand.	1 2 3 4 5
7) Cooperative learning groups motivate me to learn.	1 2 3 4 5
8) I am more likely to complete my math assignments when working cooperatively.	1 2 3 4 5
9) I am more likely to engage in math-related discussions in a cooperative group.	1 2 3 4 5
10) I attempt to participate equally when working in a cooperative group.	1 2 3 4 5
11) I am more comfortable communicating what I do not understand in a cooperative group.	1 2 3 4 5

Figure G.1. *Response from Student 5B, the Most Challenging Student of the Study*